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U. S. DEPARTMENT OF AGRICULTURE
WEATHER BUREAU
CHARLES F. MARVIN, Chief

MONTHLY WEATHER REVIEW

SUPPLEMENT No. 20

AN AEROLOGICAL SURVEY OF THE UNITED STATES

PART I. RESULTS OF OBSERVATIONS BY MEANS OF KITES

By

WILLIS RAY GREGG, Meteorologist

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

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SUPPLEMENTS TO THE MONTHLY WEATHER REVIEW.

During the summer of 1913 the issue of the system of publications of the Department of Agriculture was changed and simplified so as to eliminate numerous independent series of Bureau bulletins. In accordance with this plan, among other changes, the series of quarto bulletins—lettered from A to Z—and the octavo bulletins—numbered from 1 to 44—formerly issued by the U. S. Weather Bureau have come to their close.

Contributions to meteorology such as would have formed bulletins are authorized to appear hereafter as Supplements of the MONTHLY WEATHER REVIEW. (Memorandum from the office of the Assistant Secretary, May 18, 1914.)

These Supplements comprise those more voluminous studies which appear to form permanent contributions to the science of meteorology and of weather forecasting, as well as important communications relating to the other activities of the U. S. Weather Bureau. They appear at irregular intervals as occasion may demand and contain approximately 100 pages of text, charts, and other illustrations. Copies may be procured at the prices indicated below by addressing the Superintendent of Documents, Government Printing Office, Washington, D. C.

SUPPLEMENTS PUBLISHED.

No. 1. Types of storms of the United States and their average movements. By E. H. Bowie and R. H. Weightman. Washington, 1914. 37 p. 114 ch. 4°. Price 25 cents. (W. B. No. 538.)

No. 2. I. Calendar of the leafing, etc., of the common trees of the eastern United States. By G. N. Lamb. 19 p. 4 figs. II. Phenological dates, etc., recorded by T. Mikesell at Wauseon, Ohio. By J. Warren Smith. 73 p. 2 figs. Washington, 1915. 4°. Price 25 cents. (W. B. No. 558.)

No. 3. (*Aerology No. 1.*) Sounding balloon ascensions at Fort Omaha, Nebr., May 8, 1915, etc. By W. R. Blair and others. 67 p. 23 figs. Washington, 1916. 4°. Price 25 cents. (W. B. No. 592.)

No. 4. Types of anticyclones of the United States and their average movements. By E. H. Bowie and R. H. Weightman. Washington, 1917. 25 p. 7 figs. 73 ch. 4°. Price 25 cents. W. B. No. 600.)

No. 5. (*Aerology No. 2.*) Free-air data at Drexel Aerological Station: January, February, and March, 1916. By W. R. Blair and others. Washington, 1917. 59 p. 6 figs. 4°. Price 25 cents. (W. B. No. 603.)

No. 6. Relative humidities and vapor pressures over the United States, including a discussion of data from recording hair hygrometers for a period of about 5 years. By P. C. Day. Washington, 1917. 61 p. 7 figs. 34 charts. 4°. Price 25 cents. (W. B. No. 609.)

No. 7. (*Aerology No. 3.*) Free-air data at Drexel Aerological Station: April, May, and June, 1916. By W. R. Blair and others. Washington, 1917. 51 p. 4 figs. 4°. Price 25 cents. (W. B. No. 619.)

No. 8. (*Aerology No. 4.*) Free-air data at Drexel Aerological Station: July, August, September, October, November, and December, 1916. By W. R. Gregg and others. Washington, 1918. 111 p. 12 figs. 4°. Price 25 cents. (W. B. No. 642.)

No. 9. Periodical events and Natural Law as guides to agricultural research and practice. By A. D. Hopkins. Washington, 1918. 42 p. 22 figs. 4°. Price 25 cents. (W. B. No. 643.)

No. 10. (*Aerology No. 5.*) Free-air data at Drexel Aerological Station: January, February, March, April, May, and June, 1917. By W. R. Gregg and others. Washington, 1918. 101 p. 11 figs. 4°. Price 25 cents. (W. B. No. 651.)

No. 11. (*Aerology No. 6.*) Free-air data at Drexel Aerological Station: July, August, September, October, November, and December, 1917. By W. R. Gregg and others. Washington, 1918. 108 p. 11 figs. 4°. Price 25 cents. (W. B. No. 658.)

No. 12. (*Aerology No. 7.*) Free-air data at Drexel and the Ellendale Aerological Stations: January, February, and March, 1918. By W. R. Gregg and others; Cold winter of 1917–18. By W. R. Gregg. Description of the Ellendale Aerological Station. By V. E. Jakl. Washington, 1918. 82 p. 10 figs. 4°. Price 25 cents. (W. B. No. 660.)

No. 13. (*Aerology No. 8.*) I. Free-air data at Drexel and Ellendale Aerological Stations: April, May, and June, 1918. By W. R. Gregg and others. II. Notes on kite flying. By V. E. Jakl. Washington, 1918. 81 p. 1 fig. 4°. Price 25 cents. (W. B. No. 663.)

No. 14. (*Aerology No. 9.*) I. Free-air data at Broken Arrow, Drexel, Ellendale, and Royal Center Aerological Stations: July, August, and September, 1918. By W. R. Gregg and others. II. Broken Arrow Aerological Station. By John A. Reihle. III. Royal Center Aerological Station. By Homer W. Ball. Washington, 1919. 132 p. 22 figs. 4°. Price 25 cents. (W. B. No. 672.)

No. 15. (*Aerology No. 10.*) I. Free-air data at Broken Arrow, Okla., Drexel, Nebr., Ellendale, N. Dak., Groesbeck, Tex., Leesburg, Ga., and Royal Center, Ind., Aerological Stations, October to December, 1918, inclusive. By W. R. Gregg and others. II. The Groesbeck Aerological Station. By T. J. Chancellor. III. The Leesburg Aerological Station. By F. T. Cole. Washington, 1919. 178 p. 19 figs. 4°. Price 25 cents. (W. B. No. 687.)

No. 16. Predicting minimum temperatures from hygrometric data. By J. Warren Smith and others. Washington, 1920. 76 p. 57 figs. 4°. Price 25 cents. (W. B. No. 701.)

No. 17. Streamflow experiment at Wagon Wheel Gap, Colo. By C. G. Bates and Alfred J. Henry. Washington, 1922. 55 p. 41 figs. Price 50 cents.

No. 18. Bibliography of the climate of South America. By Margaret M. Welch. Washington, 1921. 42 p. Price 25 cents.

AN AEROLOGICAL SURVEY OF THE UNITED STATES.

PART I. RESULTS OF OBSERVATIONS BY MEANS OF KITES.

By Willis Ray Gregg, Meteorologist.

INTRODUCTION.

This "survey" will probably never be brought to a point where "Finis" can be written. It will always be possible to add to our knowledge of this, as of any other subject, although undoubtedly an increasing amount of data and the introduction of new and improved methods of observing will eventually make possible a fairly close approach to an accurate final conception of the characteristics of the free air. It might be contended that it would be better to delay publication until this state is more nearly realized than at present. But it is often true that discussion of results, as they are published from time to time brings out many points that would otherwise have been overlooked and makes possible a comparison of these results with those obtained in other parts of the world. Another consideration is the desirability of publishing data while they are comparatively new. Especially is this true at the present time so far as free-air conditions are concerned, because of the rapid development of aviation and the corresponding urgent need for information of benefit to it. It is, therefore, proposed to publish the results of free-air observations in the form of summaries as rapidly as the amount and character of the data obtained justify such a procedure. The present summary gives the results of observations made in the United States by means of kites up to and including the year 1920. For the most part the data are those obtained at the six stations established by the Weather Bureau during the period 1915 to 1918, but in figures 4 to 12 mean values have been used as determined from observations at Mount Weather, Va., and Blue Hill Observatory,[1] Mass., in order to give as complete a picture as possible of free-air conditions over the United States east of the Rocky Mountains. At a later time a review of pilot-balloon observations will be presented; also a study of the diurnal variation of the meteorological elements in the free air as determined from observations made during continuous series of kite flights. Finally, it is hoped that a treatise may be prepared which shall be based upon all of these separate compilations and discussions, as well as others not mentioned here, and which shall constitute in truth "an aerological survey of the United States."

THE KITE STATIONS—LOCATION, LENGTH OF RECORD, ETC.

In 1914 the work with kites theretofore conducted at Mount Weather, Va., was transferred to Drexel (near Omaha), Nebr., and observations were begun at the latter place in the autumn of 1915. During 1917 and 1918 five additional kite stations were established under authority of a special act of Congress providing for aerological expansion in aid of aviation. Rather detailed descriptions of all of these stations have been published in Monthly Weather Review Supplements as follows: Drexel, Nebr., No. 3, pages 29–32, 1916; Ellendale, N. Dak., No. 12, pages 12–13, 1918; Broken Arrow, Okla., and Royal Center, Ind., No. 14, pages 8–11, 1919; and Groesbeck, Tex., and Leesburg, Ga., No. 15, pages 10–13, 1919. The essential facts, so far as the present summary is concerned, are given in Table 1, which also contains similar information for Blue Hill, Mass., and Mount Weather, Va.:

Table 1.

Station.	Altitude, m. s. l.	Latitude, N.	Longitude, W.	Period of observation (inclusive).	
				From—	To—
	m.	° ′	° ′		
Broken Arrow, Okla.	233	36 02	95 49	Aug. 1918	Dec., 1920
Drexel, Nebr., Nebr.	396	41 20	96 16	Oct., 1915	Do.
Ellendale, N. Dak.	444	45 59	98 34	Jan., 1918	Do.
Groesbeck, Tex.	141	31 30	96 28	Oct., 1918	Do.
Leesburg, Ga.	85	31 47	84 14	Mar., 1919	June, 1920
Royal Center, Ind.	225	40 53	86 29	July, 1918	Dec., 1920
Blue Hill, Mass.	195	42 13	71 07	1896	1903
Mount Weather, Va.	526	39 04	77 53	July, 1907	June, 1912

NUMBER AND DISTRIBUTION OF OBSERVATIONS.

At the six stations maintained by the Weather Bureau since 1915 kite flights have been made daily, whenever possible, during the periods indicated in Table 1. Failures were due as a rule to lack of sufficient wind; occasionally to various other causes, such as very high wind, severe rain or snow storms, lack of electric power, etc. The total number of days on which flights were made is given in the first line for each station in Table 2; expressed in percentages of all days in the periods covered, the values are as follows: Drexel, 93; Ellendale, 89; Groesbeck, 83; Broken Arrow, 71; Royal Center, 67; and Leesburg, 50. The average heights reached at the different stations are, in meters above sea level: Drexel, 2,889; Ellendale, 2,715; Royal Center, 2,420; Groesbeck, 2,288; Leesburg, 2,175; and Broken Arrow, 2,127. The greatest heights are: Drexel, 6,843; Groesbeck, 6,245; Ellendale, 6,156; Leesburg, 5,860; Broken Arrow, 5,722; and Royal Center, 5,246. Table 2 also shows the number of days on which the flights reached or exceeded certain specified levels. Upon these observations are based the values given in Tables 4a to 5f; also in figures 1 to 3.

[1] This research institution was organized and conducted by the late A. Lawrence Rotch. Since his death it has been taken over by Harvard University.

TABLE 2.—*Number of observations on which are based the mean values given in Tables 4a to 5f.*

BROKEN ARROW, OKLA.

Altitude above m. s. l.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Annual.
m.																	
233	36	42	50	54	45	51	38	49	51	70	69	62	149	138	190	140	617
250	36	42	50	54	45	51	38	49	51	70	69	62	149	138	190	140	617
500	36	42	50	54	45	51	38	49	51	70	69	62	149	138	190	140	617
750	33	39	46	54	45	50	38	48	50	69	69	62	145	136	188	136	605
1,000	33	33	44	53	45	47	36	45	47	64	64	58	142	128	175	124	569
1,250	28	30	35	48	43	45	34	39	43	62	52	48	126	118	157	106	507
1,500	17	22	27	44	42	38	30	37	36	50	44	34	113	105	130	73	421
2,000	10	14	17	37	31	31	23	24	26	34	33	24	85	78	93	48	304
2,500	7	10	6	24	27	21	15	21	19	23	26	14	57	57	68	31	213
3,000	3	5	3	15	16	9	7	11	9	15	15	8	34	27	39	16	116
3,500	2	....	1	7	6	2	1	5	4	10	7	4	14	8	21	6	49
4,000	1	....	....	2	1	....	....	1	1	5	3	4	3	1	9	5	18
4,500	....	....	....	....	....	....	....	....	....	5	1	1	....	....	6	1	7
5,000	....	....	....	....	....	....	....	....	....	2	....	1	....	....	2	1	3

DREXEL, NEBR.

396	151	126	150	145	148	139	138	138	142	142	160	176	443	415	444	453	1,755
500	150	126	150	145	148	139	138	138	142	142	160	176	443	415	444	452	1,754
750	149	123	149	144	148	139	137	137	142	142	159	170	441	411	443	442	1,737
1,000	148	120	144	141	145	136	135	130	140	142	154	167	434	401	436	435	1,706
1,250	143	117	141	133	140	132	129	127	134	137	151	164	414	388	422	424	1,648
1,500	139	112	136	118	129	124	121	122	129	129	146	158	383	367	404	409	1,563
2,000	126	100	113	101	116	105	99	100	112	111	129	138	330	304	352	364	1,350
2,500	110	88	96	79	96	81	83	86	90	96	110	118	271	250	296	316	1,133
3,000	79	71	78	52	72	68	67	67	77	79	90	93	202	202	246	243	893
3,500	46	41	46	31	42	42	50	41	57	59	58	48	119	133	174	135	561
4,000	25	16	20	14	16	24	25	18	28	21	30	22	50	67	79	63	259
4,500	4	4	1	9	8	12	10	2	12	8	8	5	18	24	28	13	83
5,000	....	3	1	3	2	2	2	1	5	....	2	2	6	5	7	5	23

ELLENDALE, N. DAK.

444	78	71	82	80	89	83	82	83	79	85	83	79	251	248	247	228	974
500	78	71	82	80	88	83	82	83	79	85	83	79	250	248	247	228	973
750	78	70	80	80	87	83	82	83	78	85	81	79	247	248	244	227	966
1,000	75	69	78	77	85	81	78	82	78	83	80	78	240	241	241	222	944
1,250	71	62	76	75	81	72	74	81	71	80	78	75	232	227	229	208	896
1,500	67	56	71	70	76	67	69	78	68	77	70	71	217	214	215	194	840
2,000	54	49	60	58	61	54	55	61	58	66	56	58	179	170	180	161	690
2,500	46	35	52	39	42	44	41	50	40	54	43	44	133	135	137	125	530
3,000	32	26	40	28	33	32	29	42	25	40	36	32	101	103	101	90	395
3,500	19	17	24	16	16	20	20	25	16	32	24	20	56	65	72	56	249
4,000	11	9	13	6	6	9	5	19	7	17	11	13	25	33	35	33	126
4,500	3	3	4	4	2	3	2	9	1	7	1	5	10	14	9	11	44
5,000	2	1	2	....	....	1	1	3	....	7	....	3	2	5	7	6	20

GROESBECK, TEX.

141	49	50	60	59	50	46	45	49	48	66	79	80	169	140	193	179	681
250	49	50	59	59	50	46	45	49	48	66	79	80	168	140	193	179	680
500	47	50	59	58	49	46	44	48	46	65	77	79	166	138	188	176	668
750	42	47	57	57	48	42	40	45	45	63	71	74	162	127	179	163	631
1,000	37	46	54	56	46	37	35	42	42	57	68	67	156	114	167	150	587
1,250	35	41	52	54	44	33	30	36	37	53	66	64	150	99	156	140	545
1,500	32	39	47	51	41	27	28	30	36	49	59	61	139	85	144	132	500
2,000	29	33	36	40	33	23	15	25	31	41	48	52	109	63	120	114	406
2,500	26	24	27	28	21	16	8	18	27	34	41	35	76	42	102	85	305
3,000	17	16	17	16	9	8	4	9	20	24	24	24	42	21	68	57	188
3,500	8	7	7	5	5	2	2	3	8	15	8	16	17	7	31	31	86
4,000	3	1	5	2	....	2	....	1	2	5	2	6	7	3	9	10	29
4,500	2	....	2	....	....	....	....	....	....	1	2	3	2	....	3	5	10
5,000	1	....	2	....	....	....	....	....	....	1	1	....	2	....	2	1	5

LEESBURG, GA.

85	19	23	29	34	25	33	15	3	15	10	23	25	88	51	48	67	254
250	19	23	29	34	25	33	15	3	15	10	23	25	88	51	48	67	254
500	19	23	27	34	23	33	15	3	15	10	23	24	84	51	48	66	249
750	19	19	24	31	22	32	11	2	14	8	23	22	77	45	47	60	229
1,000	19	17	15	29	21	26	9	2	11	6	22	21	65	37	39	57	198
1,250	19	16	15	28	16	20	7	2	10	4	21	19	59	29	35	54	177
1,500	18	15	13	22	14	20	6	1	9	4	19	16	49	27	32	49	157
2,000	17	15	9	13	10	17	6	1	7	4	14	14	32	24	25	46	127
2,500	15	14	7	11	7	14	4	1	5	4	13	10	25	19	22	48	114
3,000	11	7	7	9	4	7	4	....	3	3	11	9	20	11	17	27	75
3,500	5	2	5	3	2	5	2	....	2	3	6	4	10	7	11	14	42
4,000	1	....	1	1	2	2	1	....	....	2	5	3	4	3	7	4	18
4,500	....	....	1	1	1	....	....	....	....	....	3	2	3	....	3	2	8
5,000	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	1

ROYAL CENTER, IND.

225	52	42	46	38	36	36	50	57	40	62	68	64	120	143	170	158	591
250	52	42	46	38	36	36	50	56	40	62	68	64	120	142	170	158	590
500	52	42	46	38	36	36	50	56	40	62	68	64	120	142	170	158	590
750	48	41	44	38	35	36	47	53	39	61	66	64	117	136	166	153	572
1,000	46	40	43	34	35	33	45	47	34	55	64	64	112	125	153	150	540
1,250	43	34	40	33	32	30	42	47	32	50	59	58	105	119	141	135	500
1,500	41	31	39	31	28	28	37	45	27	48	55	50	98	110	130	122	460
2,000	32	30	30	27	21	25	31	39	21	40	43	41	78	95	104	103	380
2,500	24	23	23	18	18	17	24	27	17	32	30	29	59	68	79	76	282
3,000	7	14	15	11	12	10	9	20	14	22	19	16	38	39	55	37	169
3,500	2	7	8	5	9	5	3	12	5	12	9	9	22	20	26	18	86
4,000	1	2	7	2	1	....	....	5	1	4	2	....	10	5	7	3	25
4,500	....	....	2	1	....	....	....	3	1	....	....	....	3	3	1	....	7
5,000	....	....	1	1	....	....	....	....	....	....	....	....	2	....	....	....	2

On some days two or more flights were made, either in order to reach a greater height than in the first attempt or in the course of continuous series of observations day and night, the purpose of which is to provide data for the study of the diurnal variation in the free air. None of these extra observations has been included in the computation of the mean values given in Tables 4a to 5f and in figures 1 to 3. Thus all observations have equal weight. As a rule the highest flight has been accepted, except that in the case of diurnal series none of those made at night has been considered.

In the study of free-air winds in relation to surface wind direction *all* observations made in the daytime have been used, since in this case it is not so much a monthly or seasonal average that is desired but rather the connection between conditions at the surface and those in the free air. In some instances, moreover, winds were observed when other elements were not recorded because of instrumental defects. For these reasons the total number of observations in Table 3, on which are based the values given in Tables 9a to 21 and in figures 17 to 25, is somewhat greater than the total number in Table 2.

TABLE 3.—*Number of observations on which are based the mean values given in Tables 9a to 21.*

Broken Arrow, Okla.

Season.	Altitude above m. s. l. (meters).								
	233	500	750	1,000	1,500	2,000	3,000	4,000	5,000
Spring	167	167	167	161	129	118	47	7	.....
Summer	146	146	146	139	116	97	39	6	.....
Autumn	213	213	213	200	163	123	61	15	4
Winter	147	147	147	138	92	60	26	5	1
Annual	673	673	673	638	500	398	173	33	5

Drexel, Nebr.

Season.	Altitude above m. s. l. (meters).								
	396	500	750	1,000	1,500	2,000	3,000	4,000	5,000
Spring	509	509	505	497	423	387	249	77	10
Summer	465	465	462	454	419	364	244	103	12
Autumn	504	504	503	497	460	420	289	124	19
Winter	504	504	501	489	450	412	297	96	10
Annual	1,982	1,982	1,971	1,937	1,752	1,583	1,079	400	51

Ellendale, N. Dak.

Season.	Altitude above m. s. l. (meters).								
	444	500	750	1,000	1,500	2,000	3,000	4,000	5,000
Spring	267	267	267	258	234	203	123	35	7
Summer	272	272	272	265	234	206	120	48	9
Autumn	283	283	283	277	249	223	136	56	8
Winter	239	239	238	235	208	182	109	46	9
Annual	1,061	1,061	1,060	1,035	925	814	488	185	33

Groesbeck, Tex.

Season.	Altitude above m. s. l. (meters).								
	141	500	750	1,000	1,500	2,000	3,000	4,000	5,000
Spring	197	197	191	183	161	132	59	8	2
Summer	146	146	139	123	93	77	31	3	.....
Autumn	216	214	204	189	164	146	94	21	2
Winter	206	204	196	175	145	129	70	21	4
Annual	765	761	730	670	563	484	263	53	8

TABLE 3.—*Number of observations on which are based the mean values given in Tables 9a to 21*—Continued.

Leesburg, Ga.

Season.	Altitude above m. s. l. (meters).								
	85	500	750	1,000	1,500	2,000	3,000	4,000	5,000
Spring	96	96	89	75	50	37	25	8	2
Summer	54	54	52	39	27	26	15	5	.....
Autumn	49	49	49	42	33	30	19	7	1
Winter	80	80	77	66	61	55	37	6	1
Annual	279	279	267	222	180	148	96	26	4

Royal Center, Ind.

Season.	Altitude above m. s. l. (meters).								
	225	500	750	1,000	1,500	2,000	3,000	4,000	5,000
Spring	125	125	125	120	105	92	54	18	2
Summer	146	146	143	130	116	105	61	10	.....
Autumn	196	196	194	183	156	140	83	16	.....
Winter	165	164	163	159	137	117	60	7	.....
Annual	632	631	625	592	514	454	258	48	2

RELIABILITY OF THE DATA.

Instrumental and other equipment employed in obtaining free-air records and the methods of calibrating the kite meteorographs and reducing the data have been described in detail in "Instructions for Aerological Observers," W. B. 740, 1921. They need not, therefore, be discussed here further than to remark that observational and other errors have been reduced to a minimum by frequent calibrations, by detailed notes of surface conditions during flights, and by the method employed in reducing the data, i. e., dividing the work among several computers. It is quite true that there may have been appreciable errors in individual records, but it is believed that these are largely, if not altogether, eliminated in the means of a large number, such as we are now considering. The higher levels are represented by comparatively few observations, but it should be borne in mind that changes from one level to the next at these heights are more nearly uniform than nearer the surface. Therefore a smaller number suffices to give dependable means, particularly when the method of computing those means is the one here used, viz, applying to the average surface conditions the mean gradients from each level to the next higher level, thus avoiding artificial discontinuities due to the dropping out of observations in the higher levels. The original data up to and including the year 1918 have been published in detail in MONTHLY WEATHER REVIEW SUPPLEMENTS Nos. 3, 5, 7, 8, 10, 11, 12, 13, 14, and 15 (Aerology, Nos. 1 to 10, inclusive). Since 1918 the detailed data have not been published.[2]

As indicated in Table 2, the monthly distribution of observations at all levels up to 3 or 4 kilometers is very good, except at Leesburg, where lack of wind in summer frequently made kite flying an impossibility. It should be noted, too, that the length of record at Leesburg, as shown in Table 1, is considerably shorter than that at the other stations. Drexel has by far the best and most representative series of observations, based as they are upon a 5-year record. Inasmuch as mean values for a three-year period have already been published,[3] it becomes possible to compare these values with those given here in Tables 4a to 4f. In general, the differences are not appreciable, even in the monthly means. They are greatest at and near the surface, where they amount in a few cases to 2° C. in temperature, 1 mb. in barometric pressure and vapor pressure, and 10 per cent in relative humidity. Differences in density are in no case significant. The seasonal means of all elements naturally show better agreement than the monthly means, and the annual means for the shorter and longer periods are almost identical. It is thus evident that for the determination of *normal* values, particularly those for the months, a longer series of observations is necessary than that upon which the present summary is based. The length of period required is considerably greater for the northern than for the southern section of the country, owing to the larger variability of the monthly, seasonal, and annual means of the different meteorological elements in the former than in the latter. For the same reason a longer period is necessary for the winter than for the summer half of the year. This variability difference, both territorial and seasonal, in surface temperature (and a similar difference would be found in the other elements) is well brought out in Bulletin Q,[4] pages 31–32, and accompanying Plates XVII and XVIII. As there shown, the variability is about twice as great in winter as in summer, and also in both seasons about twice as great in the North as in the South. It is difficult to specify what is a proper length of record for the determination of normals, but it could hardly be less than 20 years for the surface and for levels up to 1½ to 2 kilometers. This being the case for southern stations, it follows that at least 35 or 40 years would be necessary for stations in the Northern States. At higher levels a much shorter period is sufficient.

In considering the foregoing discussion the fact must be borne in mind that the free-air means are based upon daytime observations. There is thus a diurnal correction to be applied. Fortunately, however, the average time of the kite flights is such [5] that the mean values of the meteorological elements at the surface are very nearly the same as the 24-hour averages. The differences are, in general, so small that it is deemed unnecessary to publish them in detail, as was done in the Drexel 3-year summary.[3] Briefly, they are as follows: Pressures during kite flights are slightly higher, about 0.5 mb., than the 24-hour means, since a large proportion of the flights is made near the time of primary pressure maximum. Temperatures are likewise higher except at

[2] Although these individual records have not been published, they have been tabulated in convenient form, and copies can be lent to investigators who may wish to study them in detail.

[3] Average free-air conditions as observed by means of kites at Drexel Aerological Station, Nebr., during the period November, 1915, to December, 1918, inclusive. By W. R. Gregg. MONTHLY WEATHER REVIEW, January, 1920, 48:1–11.

[4] Climatology of the United States. By A. J. Henry. W. B. No. 361. 1906.

[5] See discussion on p. 2 of paper cited in footnote 3.

Groesbeck, where the reverse departure is found, amounting, however, to less than 0.5° C. At the other stations the plus departure is generally less than 1.0° C., except at Royal Center in summer and at Leesburg throughout the year, in which cases it is practically 2.0° C. The small percentage of days on which kites can be flown at Leesburg undoubtedly accounts for the difference there. In this connection it is significant to note that Drexel, which has the longest record and the largest percentage of days with flights, shows the smallest differences, e. g., spring, +0.4° C.; summer, +0.3°; autumn, 0.0°; winter, +0.2°; annual, +0.2°. The highest monthly is +0.8° in May. Relative humidity, as would be expected, is lower during flights than is the average of the 7 a. m. and 7 p. m. values. The difference is about 5 to 10 per cent, except at Leesburg, where it is 15 per cent. Differences in vapor pressure are insignificant. Wind speeds during flights are about 1 to 2 m.p.s. higher than are the 24-hour means, the difference being greatest in the case of the southern stations. As is well known, surface wind speeds are greater in the daytime than at night. An additional reason for the difference is the fact that kites can not be flown in light winds.

The foregoing discussion of corrections for the diurnal change refers to conditions at the surface only. At the present time not much can be said with respect to these corrections in the free air. A study of the diurnal variation of the meteorological elements at different heights is in preparation, but thus far only the temperature records at Drexel have been examined for this purpose. These show that the diurnal phase in the free air is not greatly different from that at the surface, but that the amplitude diminishes to about 1° C. at 1,500 m., remaining practically unchanged from that level up to an altitude of 3,500 m. Data for levels above 3,500 m. are lacking. It should be borne in mind that continuous day and night flights are made as a rule in weather that is clear, or at any rate free from low clouds, whereas the daily flights are made in all kinds of weather. Naturally the diurnal variation is greater in clear than in cloudy weather; hence the corrections to be applied to mean values in the present summary are undoubtedly smaller than those above given—in other words, considerably less than 1° C. Concerning the other meteorological elements little can be said at the present time as to their diurnal variation in the free air. Since the temperature phase characteristic of the surface persists at the upper levels, it necessarily follows that pressure at those levels is slightly higher during daytime than at night and therefore that a small negative correction should be applied to the values given in this summary. The diurnal range in vapor pressure and air density in the upper layers is probably too small to be considered. Free-air wind speeds, however, are less in the daytime than at night, but, on the other hand, flights are made when the surface winds are higher than the 24-hour mean. Presumably therefore the free-air values here published represent very nearly actual average conditions. More light will be thrown on this subject when observations with pilot balloons are reduced and summarized.

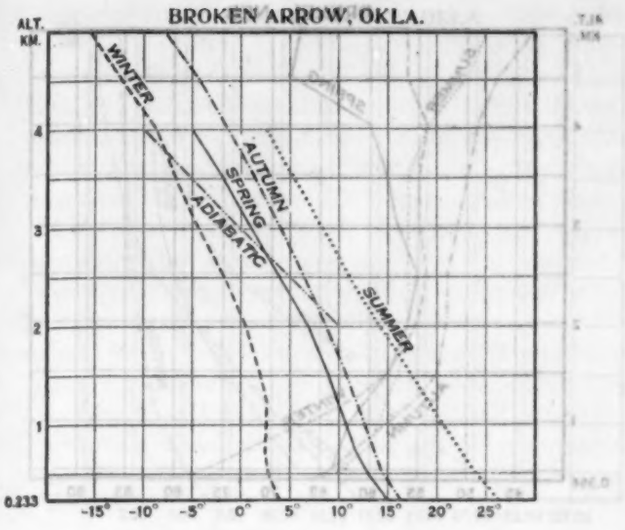
Although the statements made in the preceding paragraphs indicate that the values here given can not be accepted as representing strictly normal conditions, they also show that these values are sufficiently accurate for all practical purposes. At any rate they compare favorably with means published for Blue Hill and Mount Weather in this country and for different stations in Europe and elsewhere.

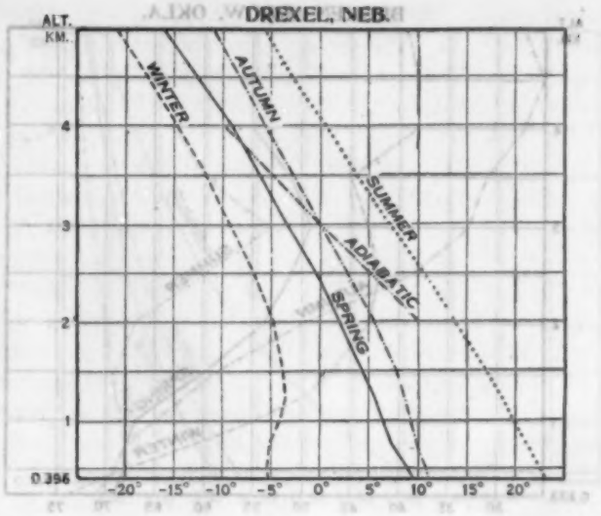
FREE-AIR DATA: MEANS.

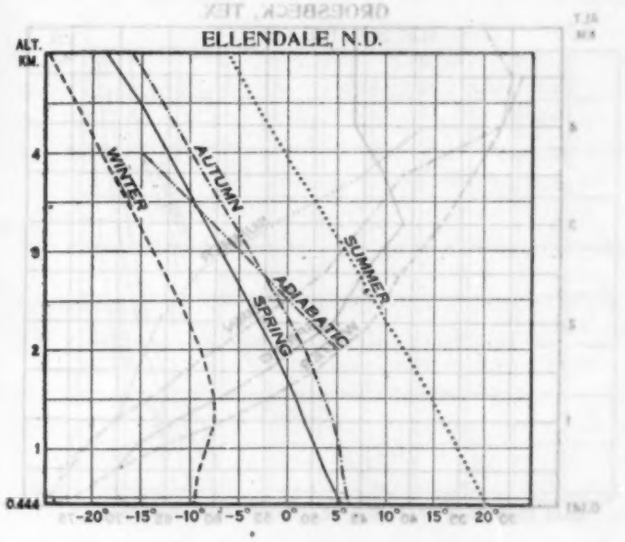
In Tables 4a to 4f may be found for the six stations the mean monthly, seasonal, and annual barometric and vapor pressures in mb., temperatures in degrees centigrade; relative humidities in percentages; densities in percentages of standard (1.293 kg. per cu. m.) and in kg. per cu. m.; and wind resultants in degrees and m. p. s. Values at sea level have been estimated by extrapolation, except barometric pressure and density, which have been computed from the estimated values of temperature and vapor pressure.

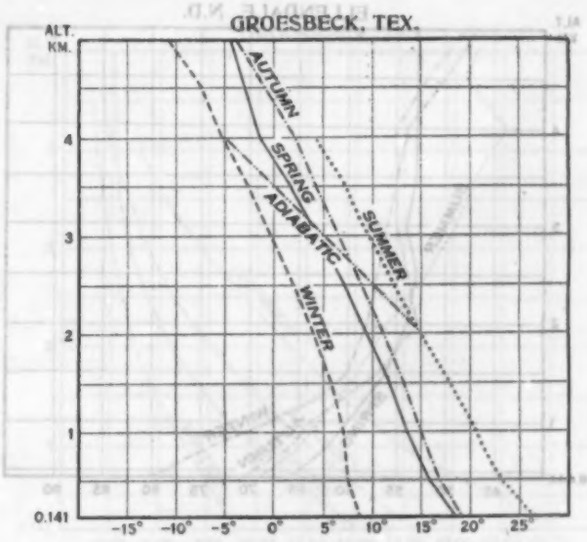
The mean seasonal values of temperature, relative humidity, and vapor pressure are shown also in figures 1 to 3. Conspicuous features are the decided permanent inversion of temperature in the lower levels at northwestern stations during the winter; the large latitudinal difference in annual temperature range, both surface and free-air; the small annual range in relative humidity at the northern stations, but the large range, with highest in summer, at the southern stations; and the substantial agreement in the annual range of vapor pressure at all stations, this range of course becoming very small in the higher levels.

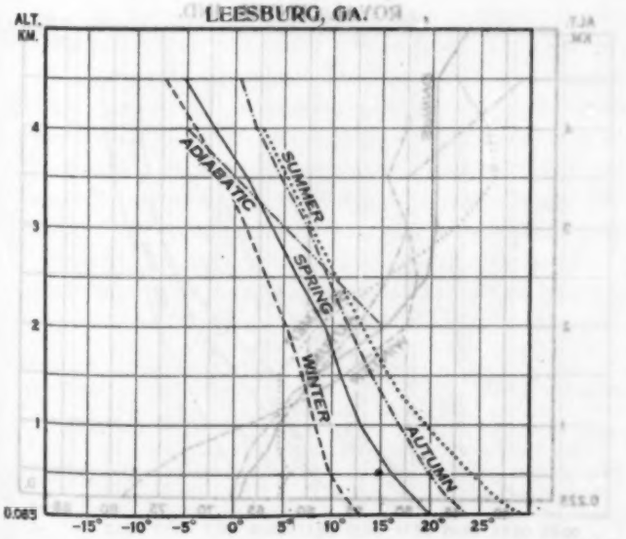
Some of the data given in Tables 4a to 4f are presented in somewhat different form in figures 4 to 12, inclusive. Each figure consists of twelve small outline maps of the United States, representing different levels and showing for those levels the mean summer, winter, or annual values of pressure, temperature, relative humidity, vapor pressure, density, and resultant wind. In order to make these maps as complete as possible for the eastern and central portions of the country, there have been included the mean values at Blue Hill, Mass., and Mount Weather, Va., each based upon a long series of observations made with kites several years ago. Since the periods covered are not the same for these and for the six Weather Bureau stations now in operation, the data are not perhaps strictly comparable, but, as already explained, seasonal and annual free-air means, based upon several years' records, are not materially changed by the inclusion of additional observations. It is believed, therefore, that these charts in general give a very true picture of actual average conditions. The values for Blue Hill have been taken from Clayton's study of the diurnal and











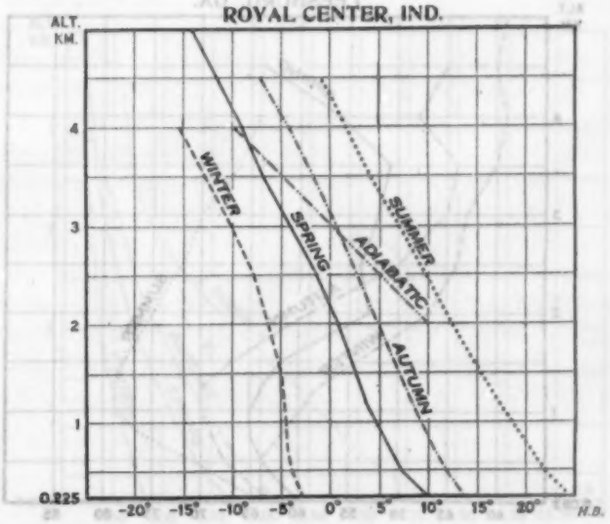
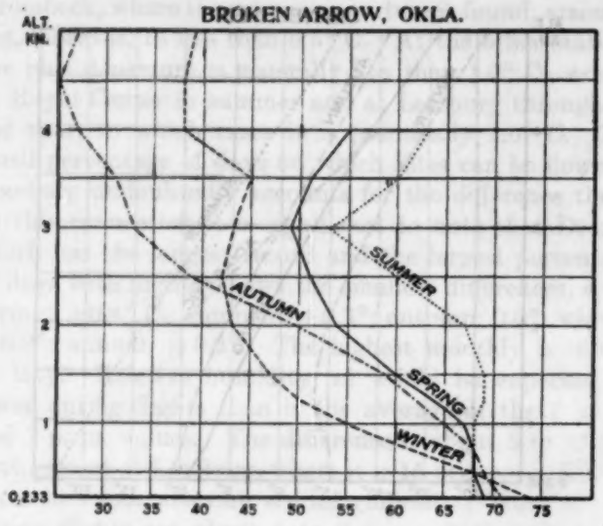
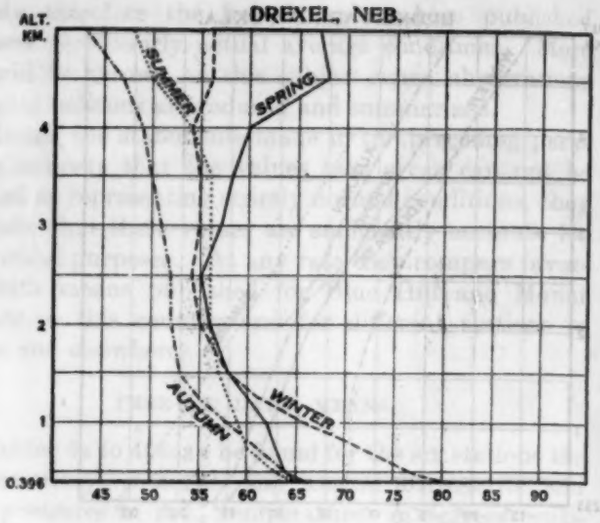
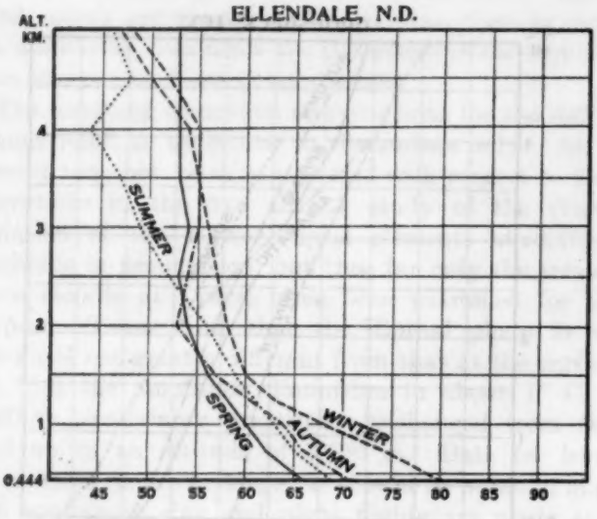
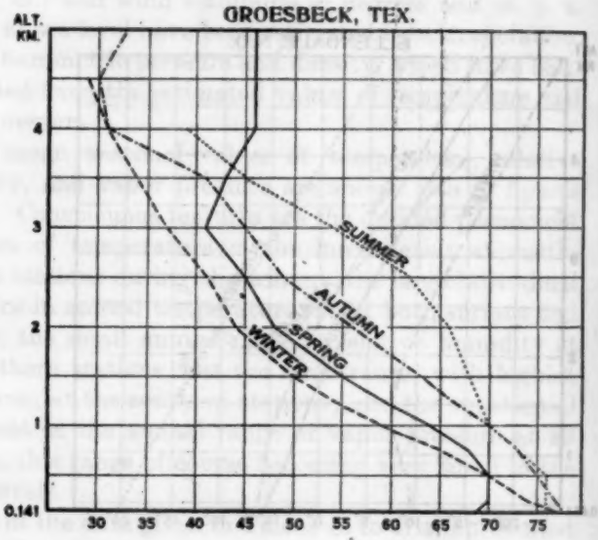


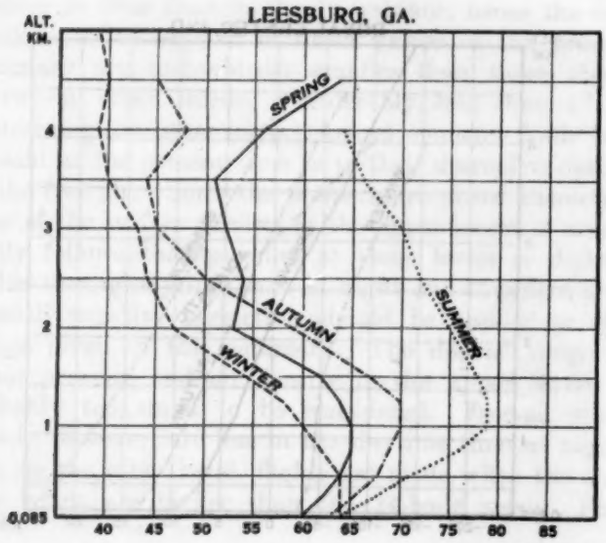
FIG. 1.—Mean seasonal free-air temperatures, °C.











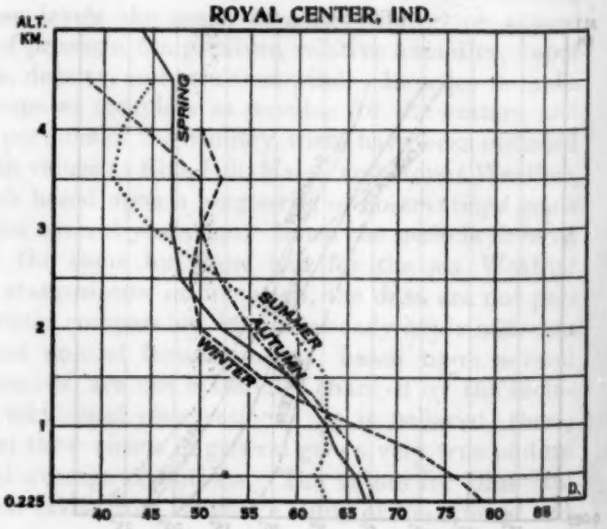


FIG. 2.—Mean seasonable free-air relative humidities, per cent.

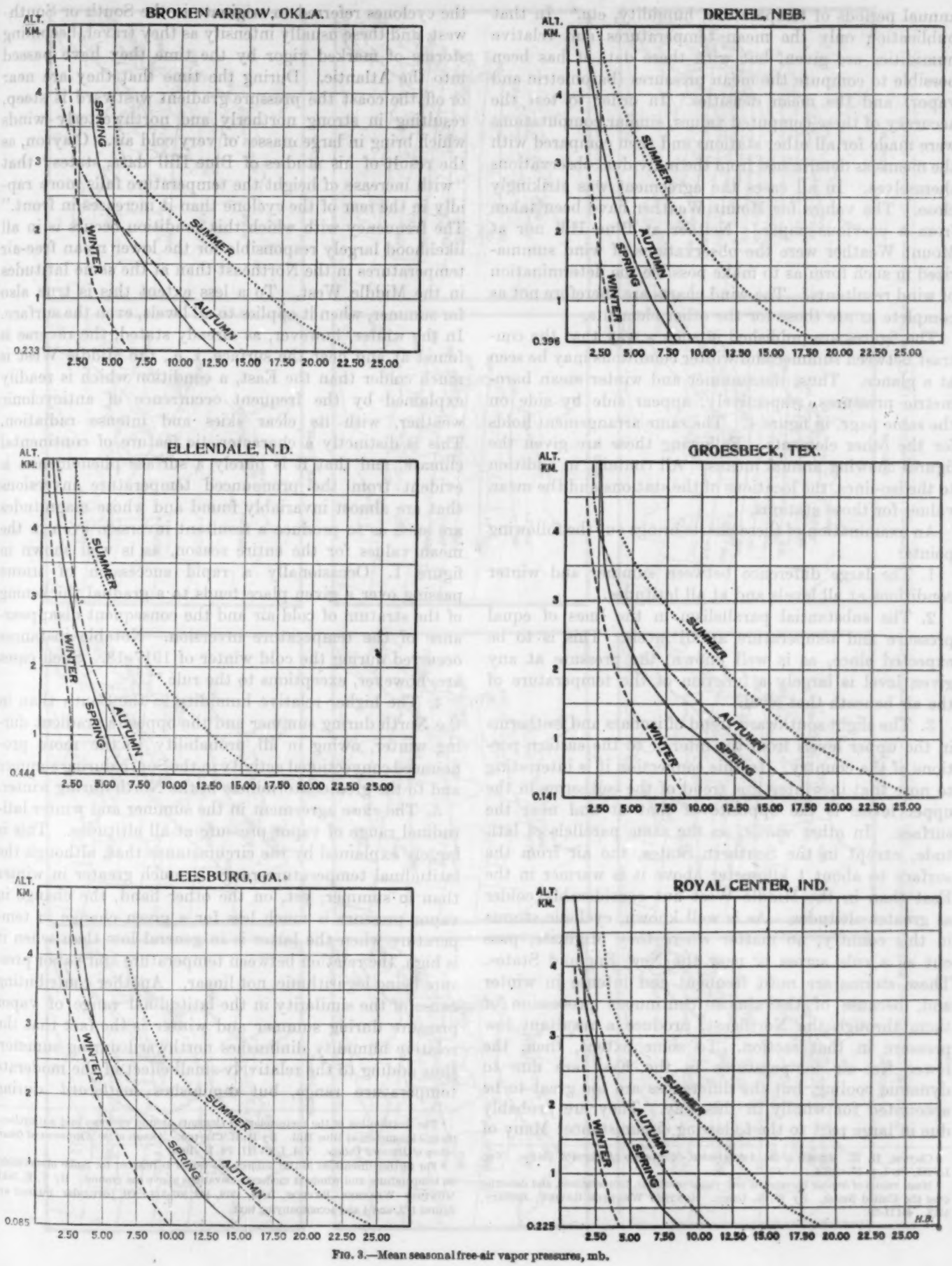


FIG. 3.—Mean seasonal free-air vapor pressures, mb.

annual periods of temperature, humidity, etc.[6] In that publication only the mean temperatures and relative humidities are given, but with these data it has been possible to compute the mean pressures (barometric and vapor) and the mean densities. In order to test the accuracy of these computed values, similar computations were made for all other stations and then compared with the means as determined from the individual observations themselves. In all cases the agreement was strikingly close. The values for Mount Weather have been taken from a previous paper.[7] Neither at Blue Hill nor at Mount Weather were the observations of wind summarized in such form as to make possible the determination of wind resultants. The wind charts are therefore not as complete as are those for the other elements.

The figures are published in such a way that the contrast between summer and winter conditions may be seen at a glance. Thus, the summer and winter mean barometric pressures, respectively, appear side by side on the same page, in figure 4. The same arrangement holds for the other elements. Following these are given the figures showing annual means. All contain, in addition to the iso-lines, the locations of the stations and the mean values for those stations.

An examination of these charts brings out the following points:

1. The large difference between summer and winter conditions at all levels and at all latitudes.

2. The substantial parallelism in the lines of equal pressure and temperature at all levels. This is to be expected since, as is well known, the pressure at any given level is largely a function of the temperature of the air beneath that level.

3. The slight southward trend of isobars and isotherms in the upper levels from the interior to the eastern portions of the country. In this connection it is interesting to note that in winter this trend of the isotherms in the upper levels is the opposite of that at and near the surface. In other words, on the same parallels of latitude, except in the Southern States, the air from the surface to about 1 kilometer above it is warmer in the East than in the Middle West but considerably colder at greater altitudes. As is well known, cyclonic storms in this country, no matter where they originate, pass out as a rule across or near the New England States. These storms are most frequent and intense in winter and, because of the almost continuous procession of them through the Northeast, produce a resultant low pressure in that section. To some extent, then, the lower free-air temperatures in the East are due to dynamic cooling, but the differences are too great to be accounted for wholly in this way. They are probably due in large part to the following circumstance: Many of the cyclones referred to originate in the South or Southwest, and these usually intensify as they travel, becoming storms of marked vigor by the time they have passed into the Atlantic. During the time that they are near or off the coast the pressure gradient westward is steep, resulting in strong northerly and northwesterly winds which bring in large masses of very cold air. Clayton, as the result of his studies of Blue Hill data, states[8] that "with increase of height the temperature falls more rapidly in the rear of the cyclone than it increases in front." The frequency with which this condition occurs is in all likelihood largely responsible for the lower mean free-air temperatures in the Northeast than at the same latitudes in the Middle West. To a less extent this is true also for summer, when it applies to all levels, even the surface. In the winter, however, as already stated, the reverse is found at and near the surface, i. e., the Middle West is much colder than the East, a condition which is readily explained by the frequent occurrence of anticyclonic weather, with its clear skies and intense radiation. This is distinctly a characteristic feature of continental climate, and that it is purely a surface phenomenon is evident from the pronounced temperature inversions that are almost invariably found and whose magnitudes are such as to produce a resultant inversion even in the mean values for the entire season, as is well shown in figure 1. Occasionally a rapid succession of HIGHS passing over a given place tends to a gradual thickening of the stratum of cold air and the consequent disappearance of the temperature inversion. Notable instances occurred during the cold winter of 1917–18. Such cases are, however, exceptions to the rule.[9]

4. The higher relative humidity in the South than in the North during summer and the opposite gradient during winter, owing in all probability to the more pronounced convectional activity in the South during summer and to the greater storminess in the North during winter.

5. The close agreement in the summer and winter latitudinal range of vapor pressure at all altitudes. This is largely explained by the circumstance that, although the latitudinal temperature range is much greater in winter than in summer, yet, on the other hand, the change in vapor pressure is much less for a given change in temperature when the latter is in general low than when it is high, the relation between temperature and vapor pressure being logarithmic, not linear. Another contributing cause of the similarity in the latitudinal range of vapor pressure during summer and winter is the fact that the relative humidity diminishes northward during summer, thus adding to the relatively small effect of the moderate temperature range, but diminishes *southward* during

[6] Clayton, H. H. *Annals of the Astronomical Observatory of Harvard College.* Vol. LVIII, Pt. I, p: 59. 1904.

[7] Mean values of free-air barometric and vapor pressures, temperatures, and densities over the United States. By W. R. Gregg. MONTHLY WEATHER REVIEW, January, 1918. 46:11-20.

[8] The distribution of the meteorological elements around cyclones and anticyclones up to 3 kilometers at Blue Hill. By H. H. Clayton. *Annals of the Astronomical Observatory of Harvard College.* Vol. LXVIII, Pt. I. 1909.

[9] For further discussion of this subject the reader is referred to: Some observations on temperatures and winds at moderate elevations above the ground. By V. E. Jakl. MONTHLY WEATHER REVIEW, June, 1919, 147: 367–373. Of particular interest are figures 1, 3, and 4 and accompanying text.

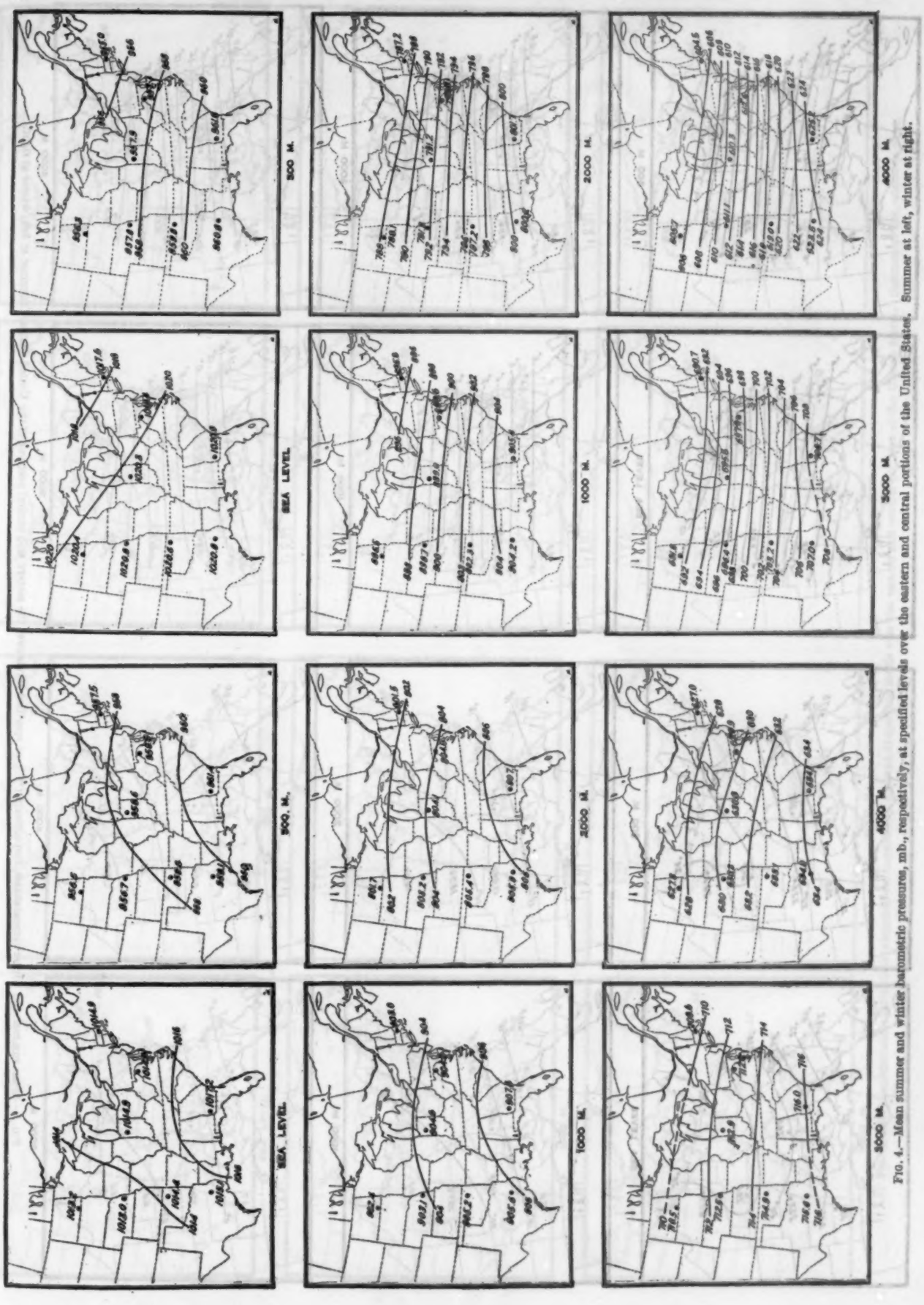


FIG. 4.—Mean summer and winter barometric pressures, mb., respectively, at specified levels over the eastern and central portions of the United States. Summer at left, winter at right.

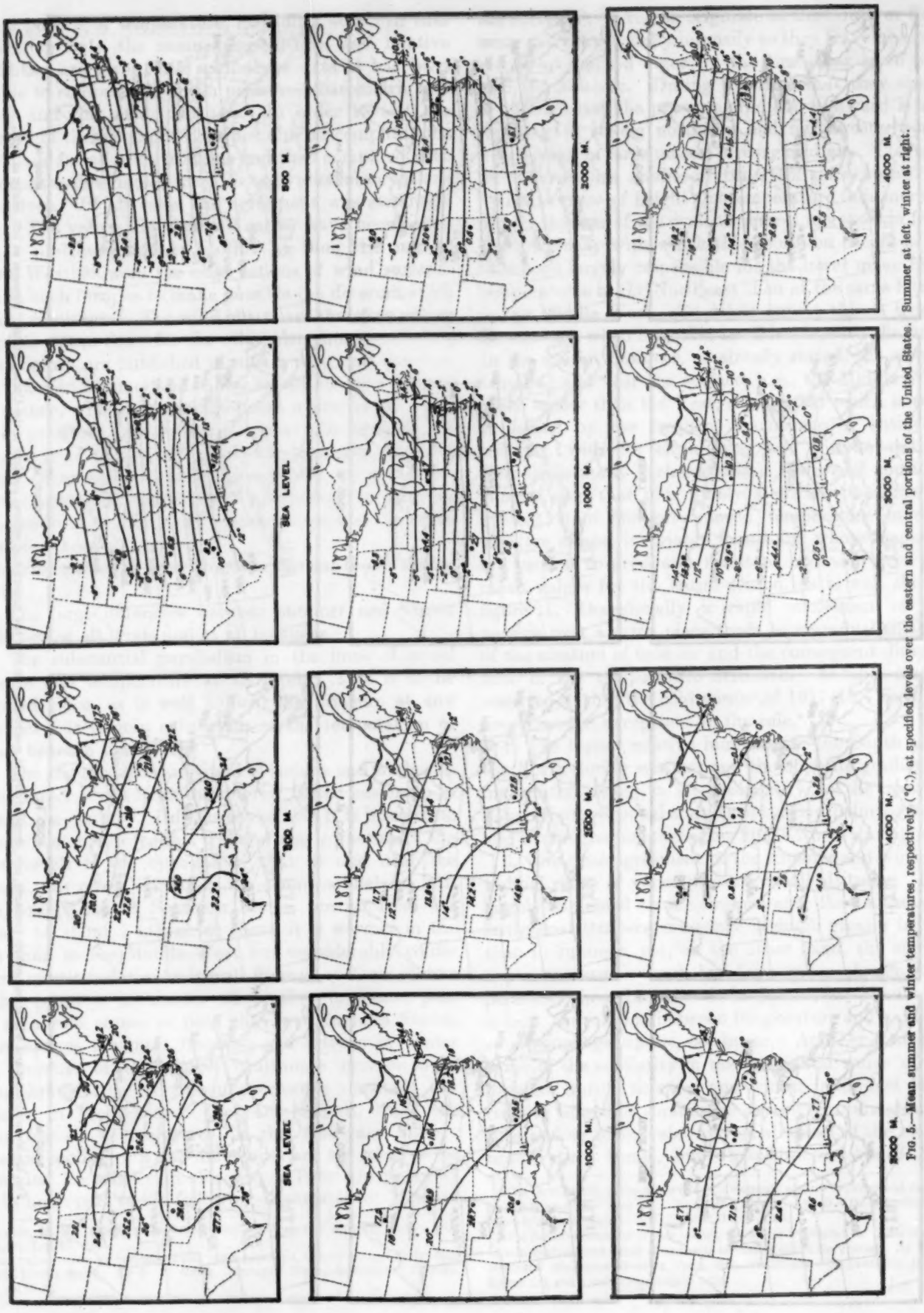


FIG. 5.—Mean summer and winter temperatures, respectively (°C.), at specified levels over the eastern and central portions of the United States. Summer at left, winter at right.

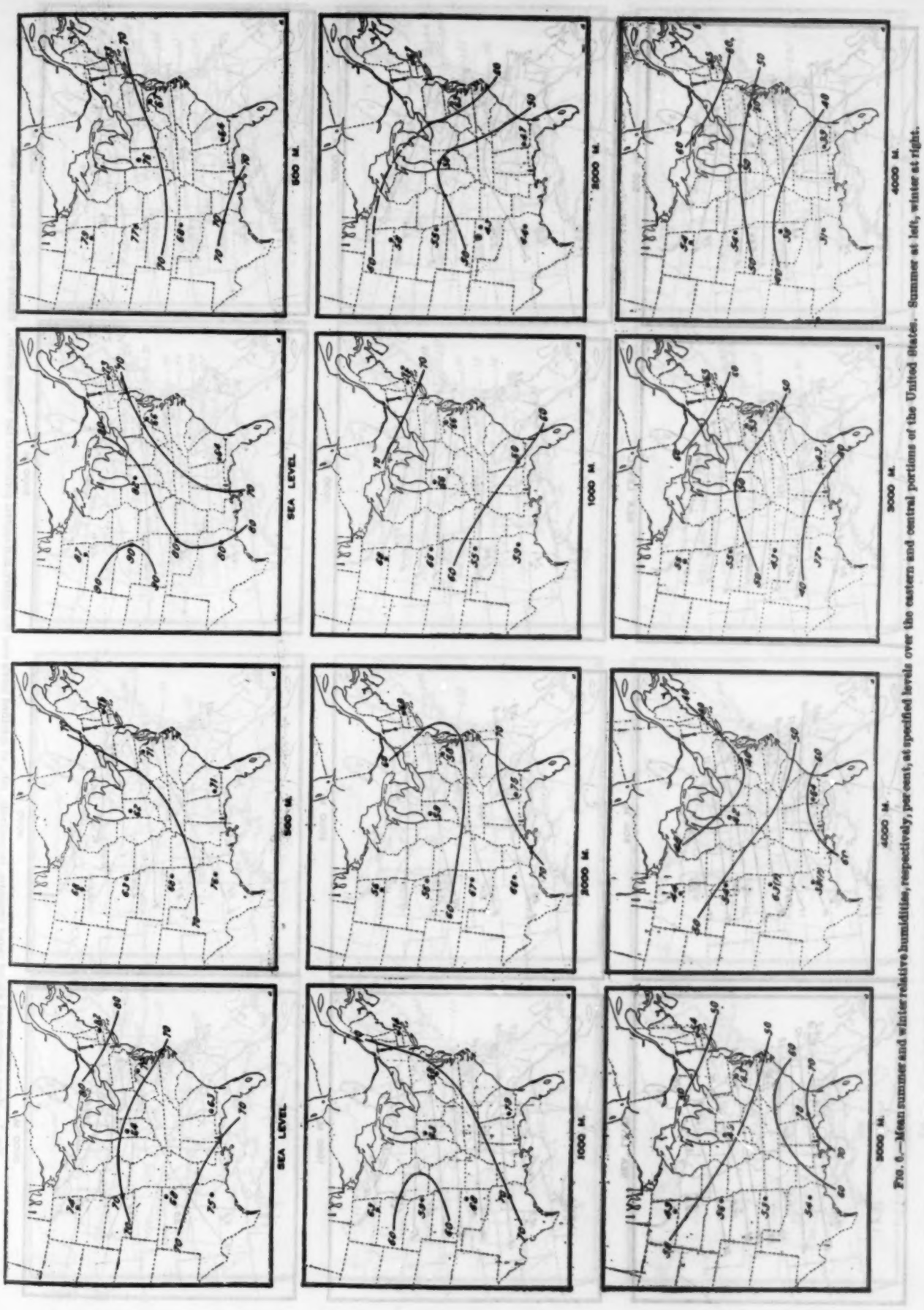


FIG. 6.—Mean summer and winter relative humidities, respectively, per cent, at specified levels over the eastern and central portions of the United States. Summer at left, winter at right.

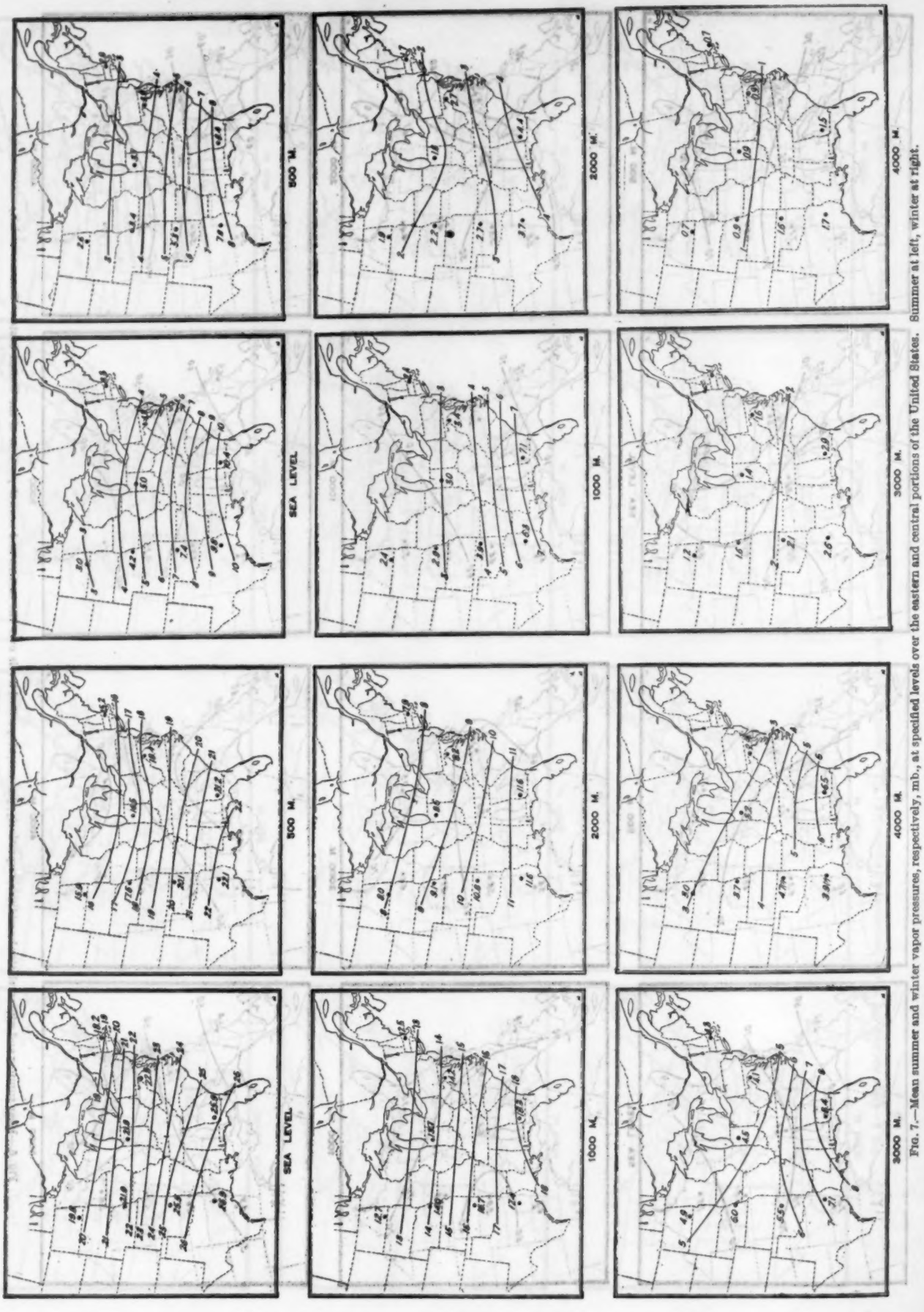


FIG. 7.—Mean summer and winter vapor pressures, respectively, mb., at specified levels over the eastern and central portions of the United States. Summer at left, winter at right.

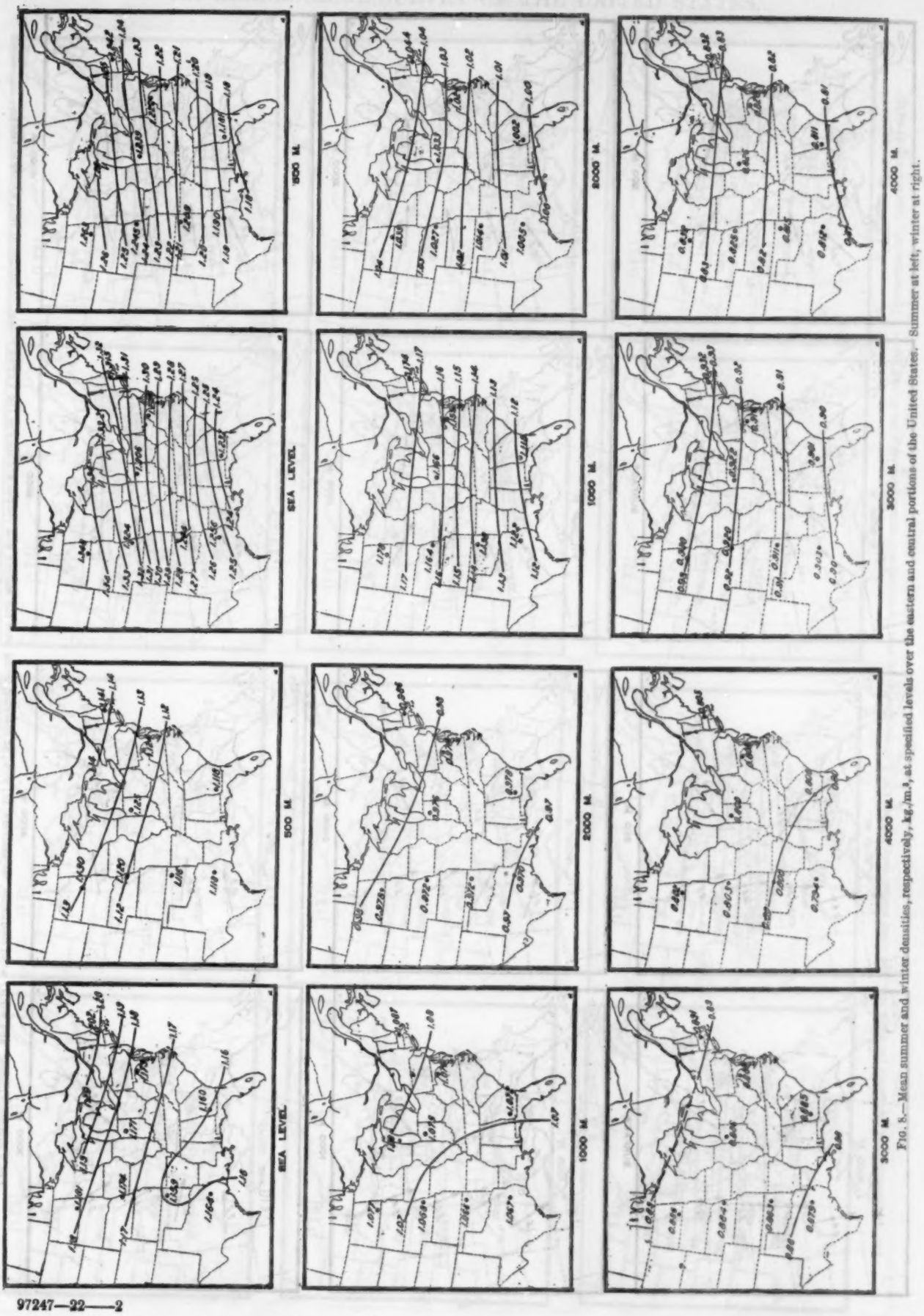


FIG. 8.—Mean summer and winter densities, respectively, kg./m.³, at specified levels over the eastern and central portions of the United States. Summer at left, winter at right.

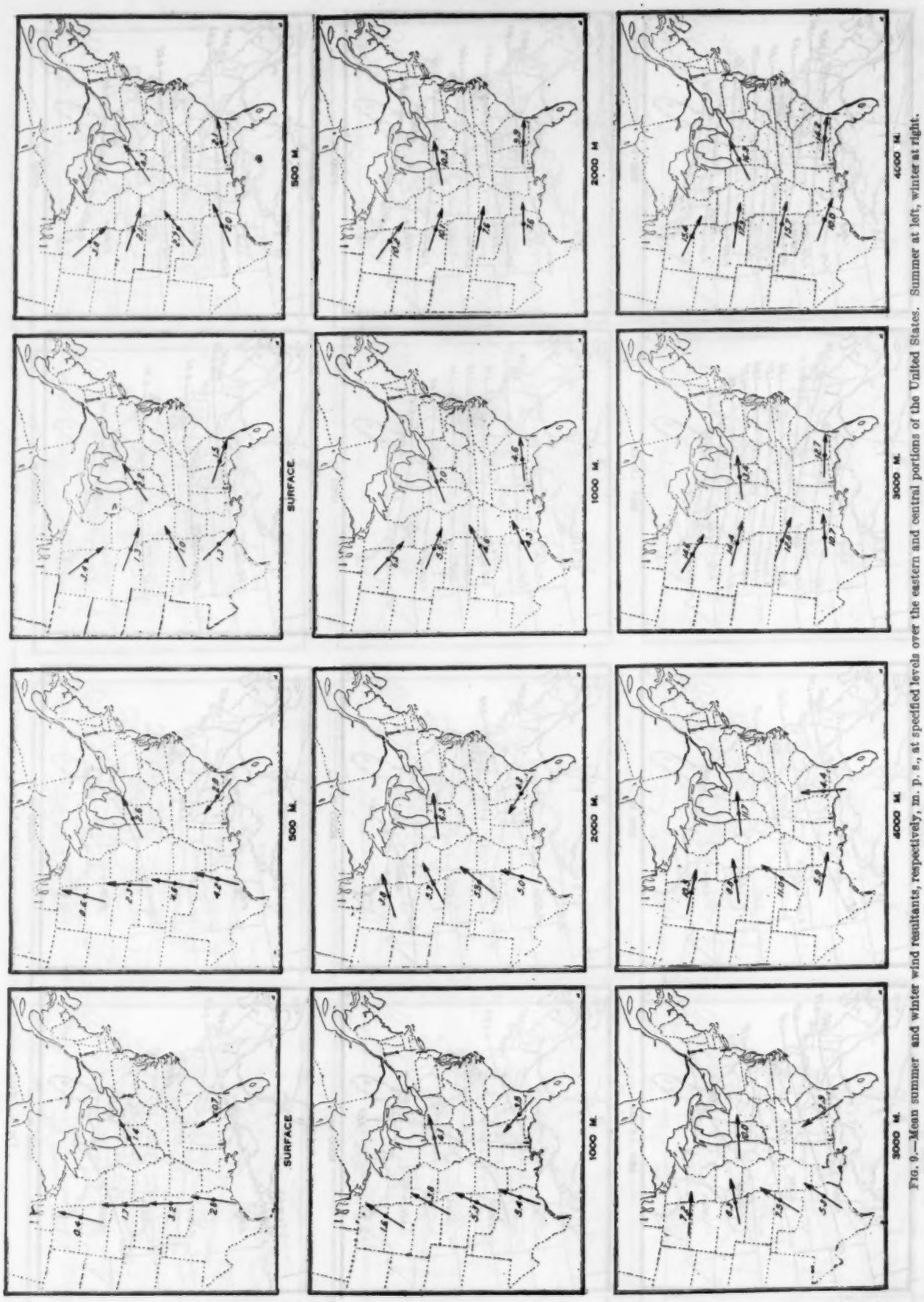


FIG. 9.—Mean summer and winter wind resultants, respectively, m. p. s., at specified levels over the eastern and central portions of the United States. Summer at left, winter at right.

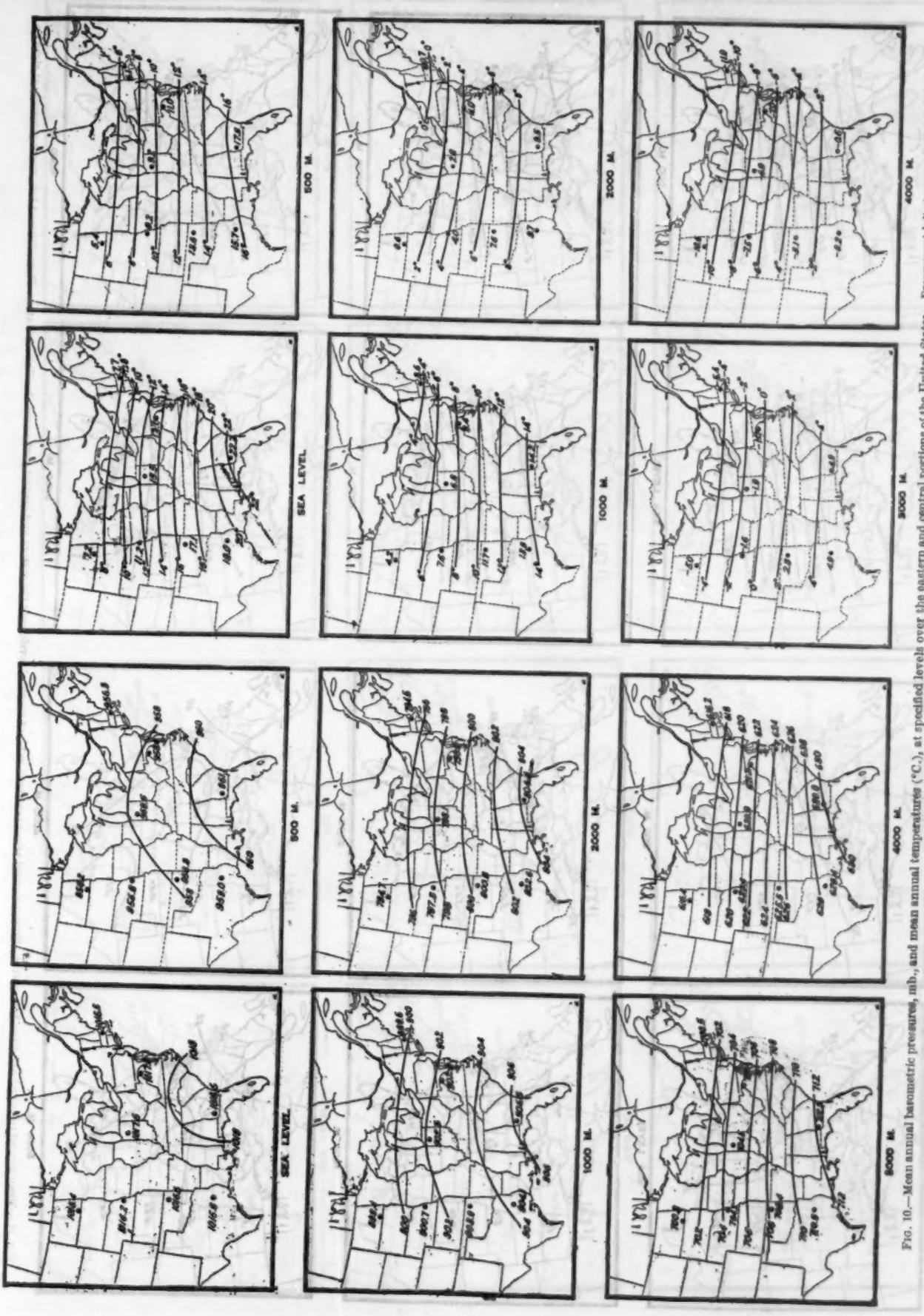


FIG. 10.—Mean annual barometric pressures, mb., and mean annual temperatures (°C.), at specified levels over the eastern and central portions of the United States. Pressures at left, temperatures at right.

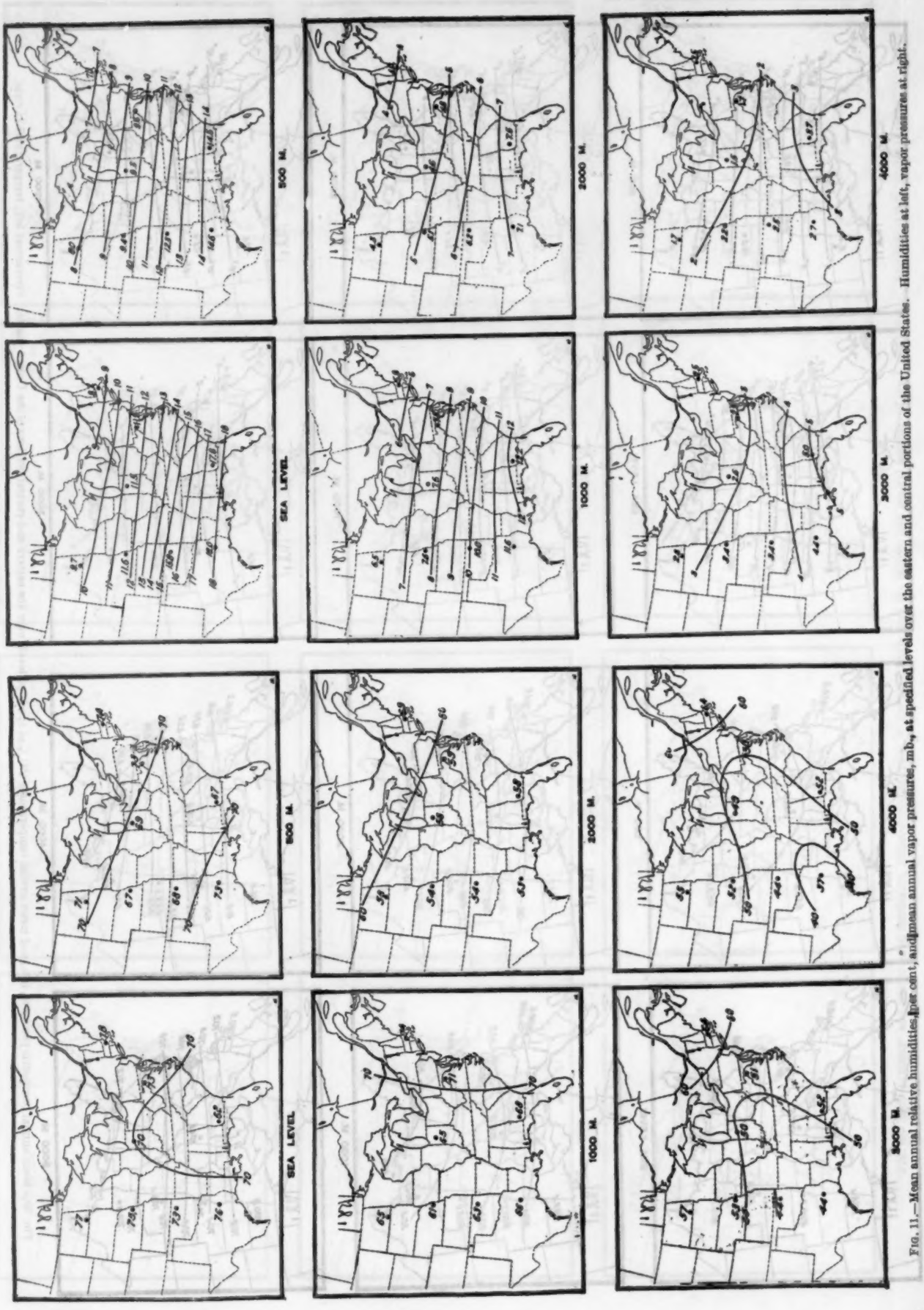


FIG. 11.—Mean annual relative humidities, per cent, and mean annual vapor pressures, mb., at specified levels over the eastern and central portions of the United States. Humidities at left, vapor pressures at right.

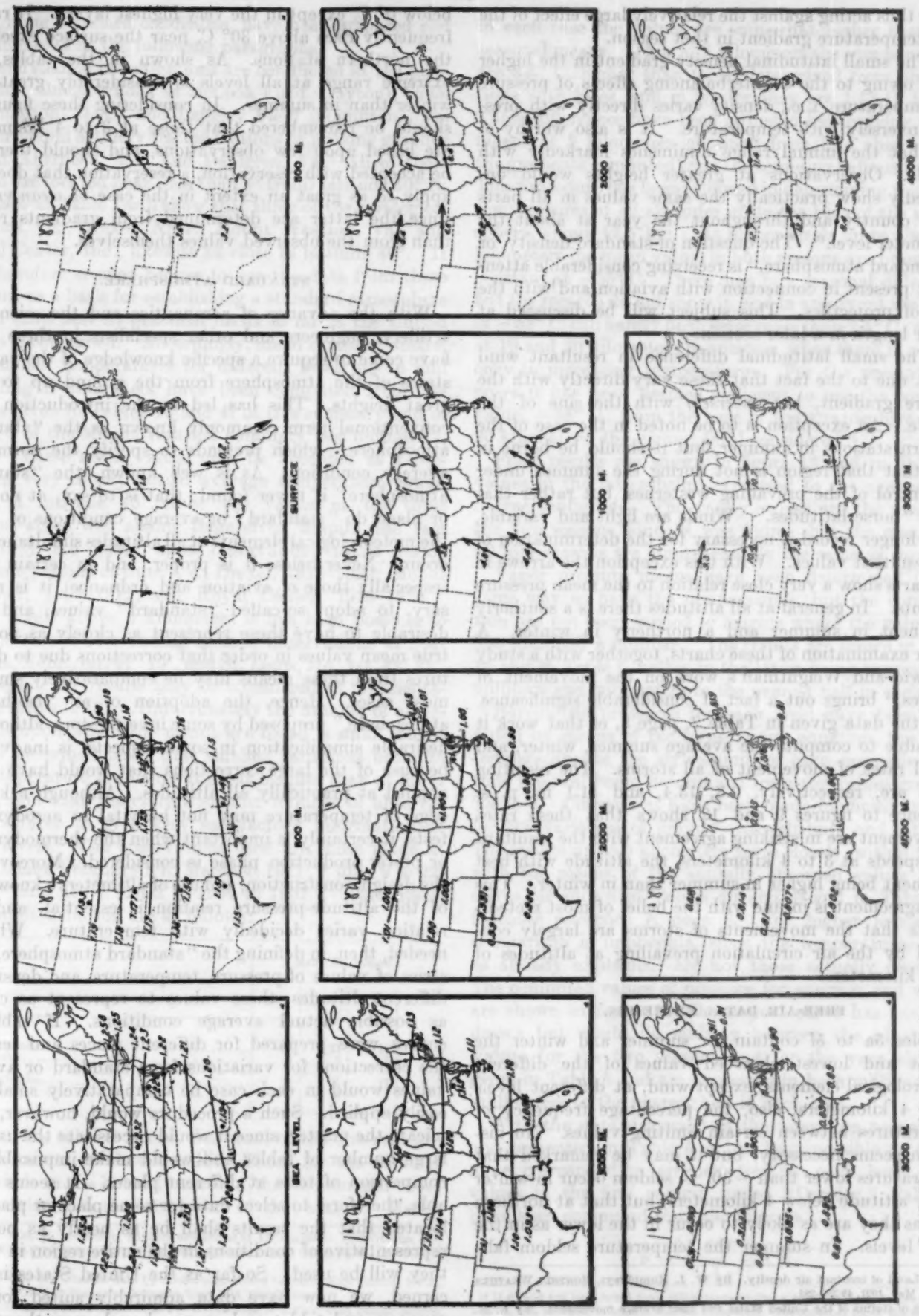


FIG. 12.—Mean annual densities, kg./m.³, and mean annual wind resultants, m. p. s., at specified levels over the eastern and central portions of the United States. Densities at left, wind resultants at right.

winter thus acting against the relatively large effect of the steep temperature gradient in that season.

6. The small latitudinal density gradient in the higher levels, owing to the counterbalancing effects of pressure and temperature, i. e., density varies directly with pressure; inversely with temperature. It is also worthy of note that the annual range diminishes markedly with altitude. Observations at greater heights would undoubtedly show practically the same values in all parts of the country and throughout the year at about the 8-kilometer level.[10] The question of standard density, or a "standard atmosphere," is receiving considerable attention at present in connection with aviation and with the firing of projectiles. This subject will be discussed at greater length in a later section.

7. The small latitudinal difference in resultant wind speeds, due to the fact that these vary directly with the pressure gradient, but *inversely* with the sine of the latitude. An exception is to be noted in the case of the southern stations in summer, but it should be borne in mind that that region is not during the summer under the control of the prevailing westerlies, but rather that of the "horse latitudes." Winds are light and variable, and a longer record is necessary for the determination of true resultant values. With this exception the arrows in the charts show a very close relation to the mean pressure gradients. In general at all altitudes there is a southerly component in summer and a northerly in winter. A further examination of these charts, together with a study of Bowie and Weightman's work on the movement of cyclones,[11] brings out a fact of considerable significance. From the data given in Table 2, page 8, of that work it is possible to compute the average summer, winter, and annual rates of movement of all storms. The resulting values are, respectively, 9.3, 13.4, and 11.1 m. p. s. Reference to figures 9 and 12 shows that these rates of movement are in striking agreement with the resultant wind speeds at 3 to 4 kilometers, the altitude with best agreement being higher in summer than in winter. This close agreement is in line with the belief of most meteorologists that the movements of storms are largely controlled by the air circulation prevailing at altitudes of 3 to 5 kilometers.

FREE-AIR DATA: EXTREMES.

Tables 5a to 5f contain for summer and winter the highest and lowest observed values of the different meteorological elements, except wind, at different levels up to 4 kilometers; also, the percentage frequency of temperatures between certain limiting values. No discussion seems necessary, but it may be remarked that temperatures lower than −30° C. seldom occur in winter at any altitude below 4 kilometers, but that at northern stations they are as likely to occur in the lower as in the upper levels. In summer the temperature seldom falls below 0° C. except in the very highest layers. It rather frequently rises above 30° C. near the surface except at the northern stations. As shown in the tables, the extreme range at all levels is considerably greater in winter than in summer. In considering these figures it should be remembered that those at 3 to 4 kilometers are based upon few observations, and should therefore be accepted with reservation, a reservation that does not apply to as great an extent in the case of *mean* values, since the latter are determined from gradients rather than from the observed values themselves.

STANDARD ATMOSPHERE.

With the advance of aeronautics and the science of artillery, engineers and other specialists in these fields have come to require a specific knowledge of the varying states of the atmosphere from the ground up to very great heights. This has led to the introduction of a conventional term commonly known as the "standard atmosphere," which pretends to specify the normal or average condition. As is well known, the "standard atmosphere" is never found; that is to say, at no time or place do "standard" or average conditions of all of the meteorological elements at all altitudes simultaneously occur. Nevertheless it is proper, and in certain fields (especially those of aviation and ordnance) it is necessary, to adopt so-called "standard" values, and it is desirable to have these represent as closely as possible true mean values in order that corrections due to departures from these means may be comparatively small in most cases. Hence, the adoption of an "isothermal atmosphere," proposed by some investigators, although a desirable simplification in some respects, is inadvisable because of the large corrections that would have to be applied at practically all altitudes. Although a knowledge of temperature may not be vital in aerodynamic tests, it certainly is important when the thermodynamic or power production phase is considered. Moreover, in the design, construction, and use of altimeters a knowledge of the altitude-pressure relation is essential, and this relation varies decidedly with temperature. What is needed, then, in defining the "standard atmosphere," is a series of values of pressure, temperature, and density, at different altitudes, these values to represent as closely as possible actual average conditions. If tables or curves were prepared for different places and seasons, the corrections for variations from standard or average values would in each case be comparatively small and easily applied. Such a procedure would, however, complicate the matter, since it would necessitate the use of a large number of tables and would make impossible the comparison of tests at different places. It seems desirable, therefore, to select data for some place or places so located that the results shall be as nearly as possible representative of conditions in the entire region in which they will be used. So far as the United States is concerned, we now have data admirably suited for this purpose, and tables and curves, based upon those data

[10] See: Level of constant air density. By W. J. Humphreys, MONTHLY WEATHER REVIEW, May, 1921, 49:280-281.

[11] Types of storms of the United States and their average movements. By E. H. Bowie and R. H. Weightman. MONTHLY WEATHER REVIEW SUPPLEMENT No. 1. 1914.

and giving standard conditions, have been prepared and are discussed in the following paragraphs.

Aerodynamic investigations are conducted at the present time almost wholly at McCook Field (Dayton), Ohio, Washington, D. C., and Langley Field (Hampton), Va. The principal artillery testing stations or proving grounds are at Aberdeen, Md., and Dahlgren, Va. All of these places are located near (less than 3° from) latitude 40° N. A glance at Table I will show that three of the aerological stations, viz., Drexel, Nebr., Mount Weather, Va., and Royal Center, Ind., likewise lie close to latitude 40°. It has therefore seemed proper to use the data from these stations as a basis for establishing a standard atmosphere which shall best fit practical needs so far as the United States is concerned. Accordingly, mean summer, winter, and annual temperatures for different levels up to and including 5 kilometers have been computed from the values given in Tables 4b and 4f of this summary and in Table I of the Mount Weather summary (see footnote 7, p. 8). These mean values may be accepted as representing very closely actual average temperature conditions at latitude 40°, since the values at the three stations agree well among themselves, despite the fact that they are based upon observations taken during different periods of time, i. e., Drexel, 1915–1920; Mount Weather, 1907–1912; and Royal Center, 1918–1920.

For levels above 5 kilometers it has been possible to use the results of sounding balloon observations at Fort Omaha, Nebr., lat. 41° 19′, and St. Louis, Mo., lat. 38° 38′. Here again the results may be considered as representative of latitude 40°. Unfortunately the number of observations upon which the means are based is small, but it should be remembered that smaller variations occur in the temperature gradients at great heights than at lower levels, and that therefore a smaller number of observations suffices to give very satisfactory information at those levels. The observations used are those made at Fort Omaha February 8 to March 4, 1911;[12] July 9 to 22, 1914;[13] and at St. Louis in 1904 to 1907.[14] Their number and distribution are as follows:

	Altitude (meters).			
	5,000	10,000	15,000	20,000
Summer:				
Fort Omaha	17	17	14	9
St. Louis	6	5	1	0
Winter:				
Fort Omaha	21	21	17	7
St. Louis	6	2	1	0

From this table it is seen that most of the observations were obtained at Fort Omaha. Those for the summer were made in the hottest month of that season and those for the winter in the latter part of that season. Hence in each case the values are somewhat higher than true seasonal means. Thus at 5 kilometers the summer values are 3.5° C. higher than those determined from observations with kites, and in winter they are 1.5° C. higher. These differences have been adjusted by applying to the means at 5 kilometers obtained from kite observations the gradients computed from the sounding balloon records. This procedure has been followed in determining the mean temperatures at all altitudes up to the base of the stratosphere, about 12.5 km. At higher levels up to about 20 kilometers the mean values in both seasons are practically constant at −55° C. There may be a seasonal difference, but the records do not show it, and in any event the value of −55° C. can hardly be in error more than 2.5° C., except at 19 and 20 kilometers in summer, when there is a tendency to increasing temperatures. For the present purposes it has been deemed sufficient to use the constant value, −55° C., from the base of the stratosphere up to 20 kilometers, the highest level considered.[15]

Final results are shown in figure 13 and in Table 6, values in the latter being expressed to the nearest half degree centigrade. The yearly values are the means of the two seasons, since it was found that the means for all four seasons are almost exactly the same as these.

Vapor pressure means have been determined in the same way as have the temperatures, but the computation has not been carried to heights where the values are less than half a millibar. The results are shown in figure 14 and in Table 6, values in the latter being expressed in millibars and millimeters to the nearest half in each case.

Barometric pressures for each level have been computed by means of the hypsometric equation, the mean temperatures of the air column for each successive altitude interval being determined from the values given in Table 6. Corrections have been made for humidity and for the variation of gravity with altitude and latitude. The results up to 5 kilometers agree closely, within 1 mb., with the means of the actually observed values themselves, as shown in Tables 4b and 4f and in Table 1 of footnote reference 7, page 8. For higher levels this comparison is impossible, since the temperatures used, as already explained, are not those actually observed. The computed values of pressure for summer and winter are shown in figure 15; the annual curve has not been drawn but would lie midway between the other two. Values for the two seasons and for the year also are given in Table 6 and are expressed in both millibars and millimeters to the nearest half in each case.

With the data discussed in the preceding paragraphs and presented in Table 6 it has been possible to determine corresponding air densities for each level. The values in the first column under "Density," Table 6 have been computed from the formula

$$\rho' = \frac{b - 0.378e}{T} \times K,$$

[12] Blair, Wm. R. Sounding balloon ascensions at Indianapolis, Fort Omaha, and Huron. BULLETIN OF THE MOUNT WEATHER OBSERVATORY, vol. 4, pt. 4. pp. 183-304. 1912.

[13] Blair, Wm. R. Free-air data by means of sounding balloons, Fort Omaha, Nebr., July, 1914, MONTHLY WEATHER REVIEW, May, 1916, 44:247-264.

[14] Clayton, H. H., and Fergusson, S. P. Exploration of the air with ballons-sondes, at St. Louis. *Annals of the Astronomical Observatory of Harvard College.* Vol. LXVII, Pt. I, 1909.

[15] It should not be inferred from this statement that a constant temperature of about −55° C. will be found at heights above 20 kilometers. On the other hand, the few observations thus far made, mostly in summer, show increasing temperatures with height reaching values between −35° C. and −40° C. at 25 to 30 kilometers.

in which

ρ' = density expressed in percentage of standard density,

b and e = barometric and vapor pressures, respectively, in mb.,

T = temperature in °A,

and K = a constant, depending upon the conditions of pressure and temperature that are accepted as standard, in this case 1,013.3 mb. and 0° C, or $K = 0.26942$.

The values in the second column have been obtained by multiplying those in the first by 1.293 kg. per cu.m., the density at 1,013.3 mb. and 0° C., or $\rho = \rho' \times 1.293$. These values for the summer and winter are shown in figure 16; the annual curve, if drawn, would lie very nearly midway between the other two.

In order to facilitate comparison with densities that have been computed for other parts of the world, Table 7 has been prepared. So far as known to the writer these are all that have been published thus far. In most cases only annual values have been given. These are presented in Table 7 in such a way that the latitudinal variation may be seen at a glance. A striking feature is the essential agreement in the density at about 8 kilometers, both in summer and winter and at all latitudes. (See footnote reference 10, p. 18.)

Table 7 also contains, in the last column, the values computed from Toussaint's formula. This formula has been discussed in a previous paper. (See footnote 4 in the table.) Briefly, Toussaint has proposed the adoption, by all countries, of a "law" of linear decrease of temperature with altitude, starting at a temperature of 15° C. at sea level and attaining −50° C. at an altitude of 10,000 meters. This "law" is expressed by the formula

$$t = 15 - 0.0065Z,$$

in which

t = temperature in °C

and Z = altitude in meters.

Using the temperatures at various levels, as deduced from this formula, and assuming that the atmosphere is dry and that gravity remains constant, the author has computed values of pressure and density for different heights up to 10 kilometers. The results, in abridged form, are as follows:

Altitude, m. s. l.	Pressure.	Temperature.	Density.
m.	*mm.*	*°C.*	*kg./cu. m.*
0	760.0	15.0	1.225
500	714.0	12.0	1.165
1,000	673.5	8.5	1.112
1,500	634.0	5.0	1.060
2,000	596.0	2.0	1.008
2,500	560.0	−1.0	0.957
3,000	525.5	−4.5	0.907
4,000	462.0	−11.0	0.820
5,000	405.0	−17.5	0.735
6,000	354.0	−24.0	0.660
7,000	308.0	−30.5	0.588
8,000	267.0	−37.0	0.525
9,000	230.5	−43.5	0.467
10,000	198.0	−50.0	0.413

Concerning these figures, Toussaint says:

> It has been found preferable to take a linear law rather than to seek an equation approximate to Professor Gamba's curve, for the following reason:
>
> In order to define the standard atmosphere, what is needed is not an exact representation of that curve, but merely a law that can be conveniently applied and which is sufficiently in concordance with the means adhered to. By this method, corrections due to temperature will be as small as possible in calculations of airplane performances, and will be easy to calculate. The proposed law seems likely to realize such conditions.
>
> The deviation is of some slight importance only at altitudes below 1,000 meters, which altitudes are of little interest in aerial navigation. The simplicity of the formula largely compensates this inconvenience.
>
> It must be remarked, however, that since the isothermal layers seem to commence, in European regions, at an altitude of about 11,000 meters, it would be dangerous to extrapolate above that altitude.
>
> When it becomes an ordinary occurrence for airplanes to attain that altitude, it will be necessary to modify the law, but it suffices for the machines now in use.

Although the adopted rate of temperature decrease is arbitrary, the resulting values of density agree very well with those actually computed from European mean temperatures and pressures. Reference to Table 7 will show that the agreement with densities at latitude 40° in the United States is equally good. In fact, nowhere except at sea level, does the difference equal 1 per cent and at that level it is only 1.2 per cent. At 10 kilometers, the highest altitude for which Toussaint has computed a value, the difference is considerably less than 0.5 per cent.

In view of the close agreement above indicated and the desirability of having uniform practice in different countries, it seems appropriate to recommend the adoption of Toussaint's values, *providing one set is deemed sufficient for use throughout the year*. France and Italy officially accepted them in 1920, and England has done so more recently.[18] It is to be noted, however, that Toussaint has not carried his computations above 10 kilometers. At the present time there is perhaps little need for values at higher levels, so far as aviation is concerned, but there will almost certainly be such a need in the future. Moreover, even now the artillerist needs them. Toussaint's "law" of temperature decrease will not apply even approximately at altitudes above 11 or 12 kilometers, as clearly shown in Table 6 and in figure 13. It seems wise, therefore, to adopt for levels above 10 kilometers the values given in Table 7 for the United States, or else composite values, based upon the means for this country and for Europe. In either case there would be no appreciable discontinuity at 10 kilometers since the means in both countries at that altitude are in substantial agreement with those given by Toussaint.

In the event that annual means are not considered sufficient for practical use, it is recommended that the values in Table 6 for summer, winter, and the year be adopted by the United States. Additional observations in the future will hardly change these values to such an extent as to require any revision. The summer means

[18] Aeronautics. Report of the (British) Aeronautical Research Committee for the year 1920–21, p. 38.

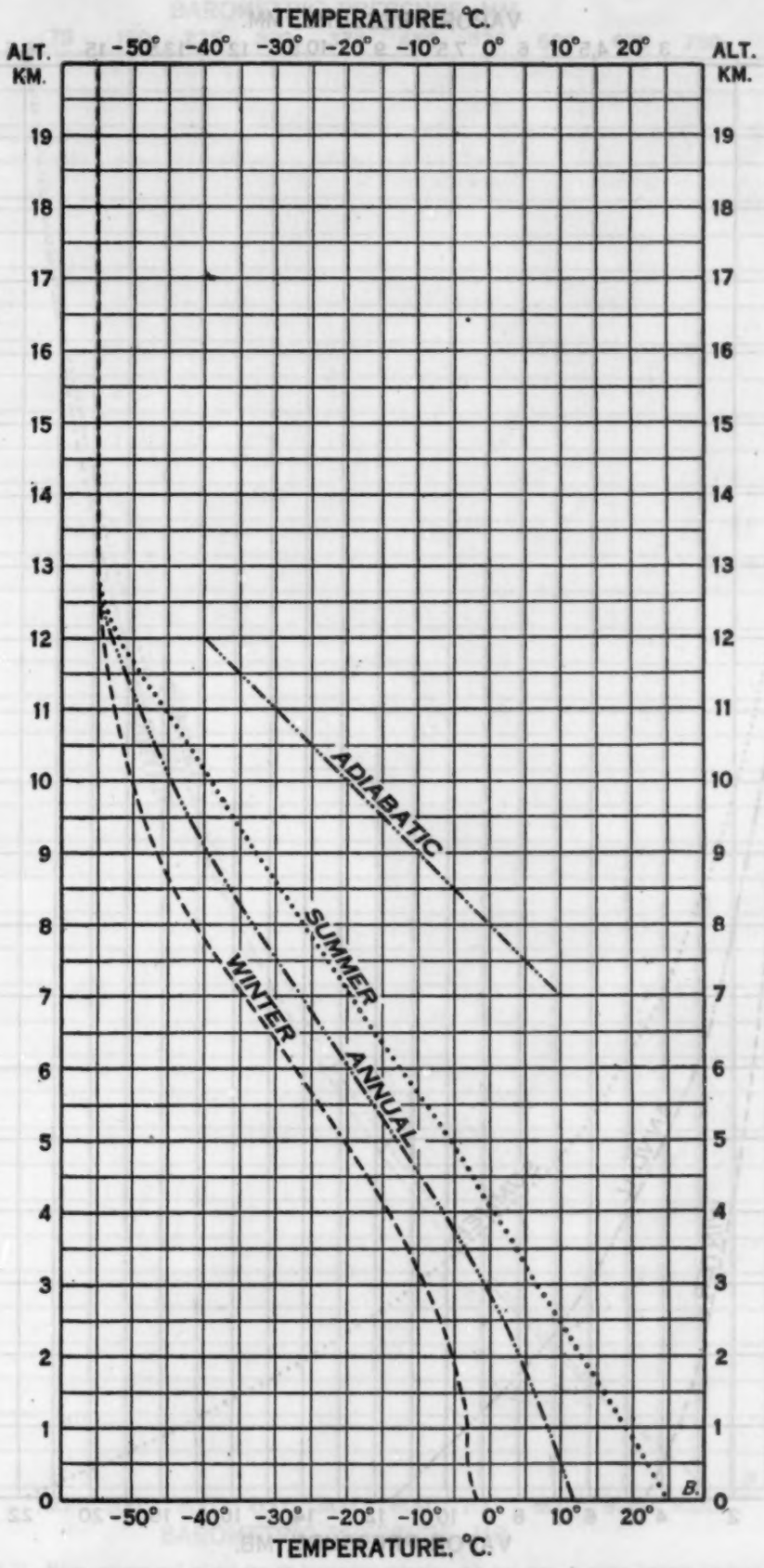


FIG. 13.—Mean summer, winter, and annual free-air temperatures, (°C.), at about latitude 40° in the United States.

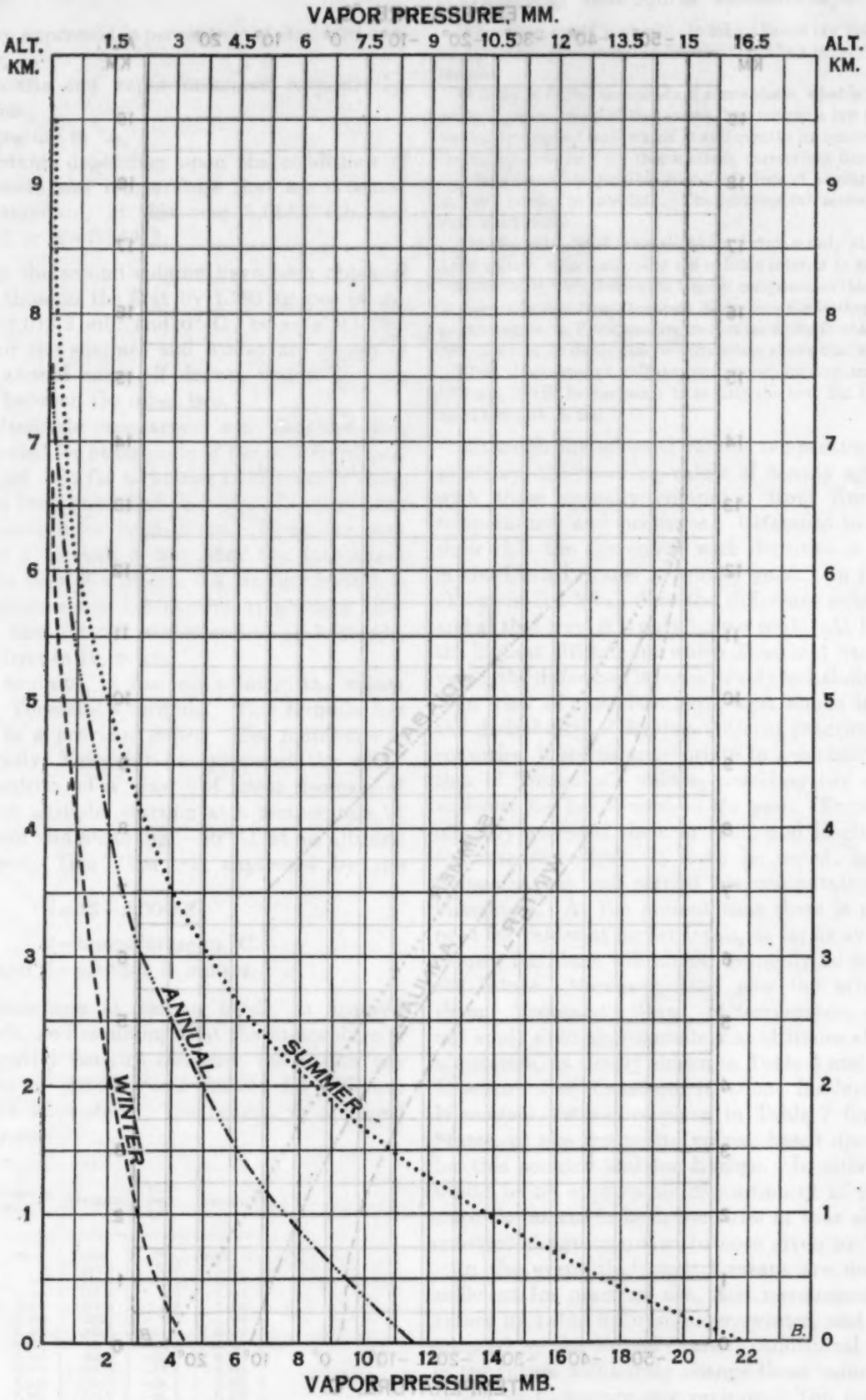


FIG. 14.—Mean summer, winter, and annual free-air vapor pressures, mb. and mm., at about latitude 40° in the United States.

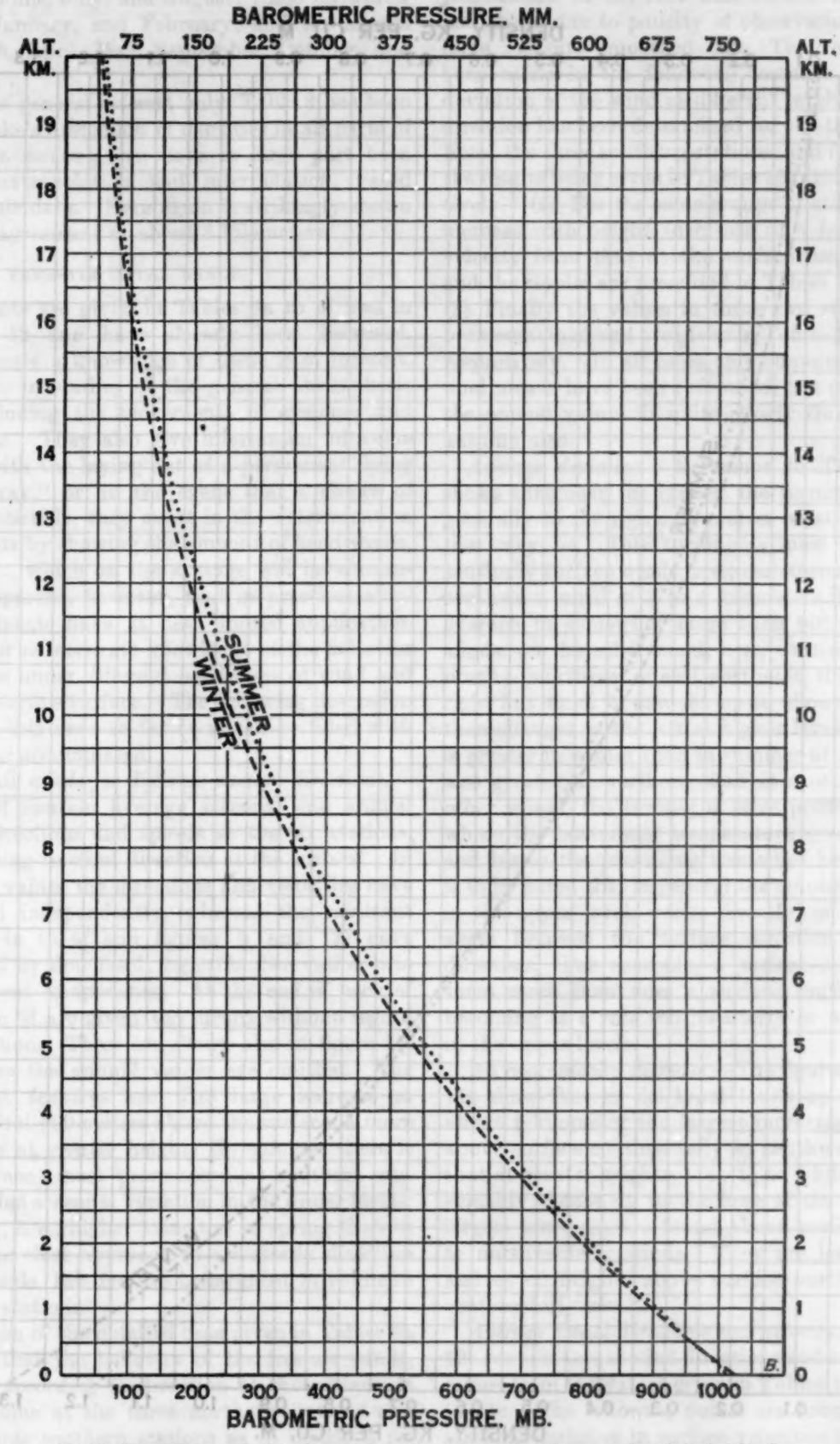


FIG. 15.—Mean summer and winter free-air barometric pressures, mb. and mm., at about latitude 40° in the United States.

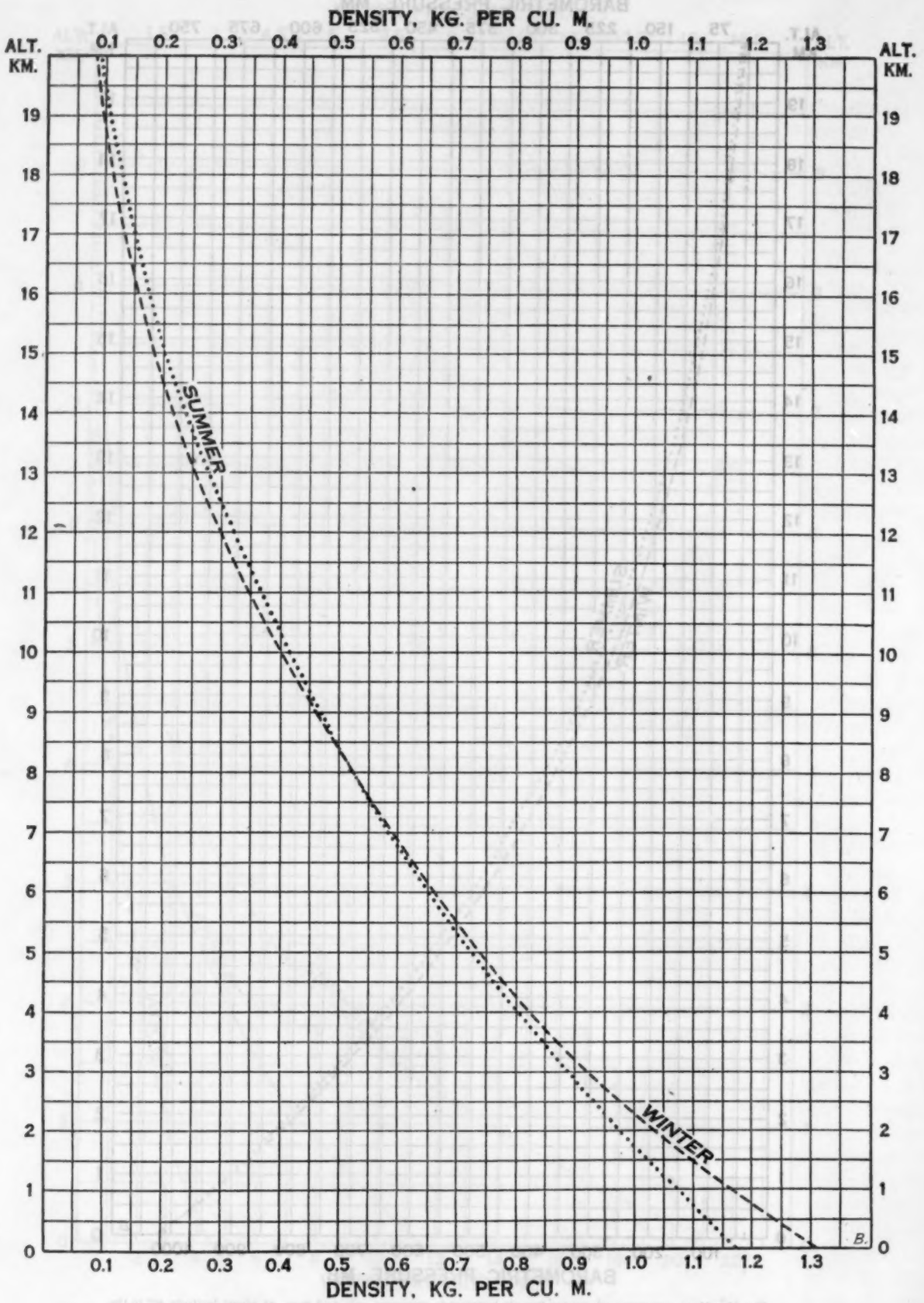


FIG. 16.—Mean summer and winter free-air densities, kg. m.^{3} m., at about latitude 40° in the United States.

would apply to June, July, and August; those for winter to December, January, and February; and the annual means to March, April, May, September, October, and November.

As a matter of general interest only, Table 8 has been copied from Linke's discussion of densities in all parts of the world. The means given have in large part been estimated by extrapolation and interpolation, based upon all available data. Here again is strikingly shown the substantial agreement at about 8 kilometers.

FREE-AIR DATA: WINDS.

Wind resultants are given in Tables 4a to 4f and in figures 9 and 12 and have already been discussed. For many purposes a knowledge of these is of interest, as, for example, in studies of the general atmospheric circulation, including the movements of cyclones and anticyclones, etc. They also give information of value in connection with the laying out of a permanent flying course or "airway," or, in the event that a choice of routes is impracticable, they assist in the determination of operating costs by showing the amount of head winds, cross winds, etc., which on the average will be encountered. It is apparent, however, that in practical aviation wind resultants have at best limited application. There is need for an accurate knowledge of the behavior of free-air winds under different conditions of wind and weather at the earth's surface. The following discussion attempts to fill this need so far as it can be filled with the data thus far accumulated.

Average free-air winds for different surface directions.—Tables 9a to 9f contain average seasonal and annual free-air wind directions and speeds at the six stations, classified according to wind direction at the surface. In obtaining these values the directions and velocities have been considered independently, whereas the resultant winds (Tables 4a to 4f and figures 9 and 12) have been determined by first resolving each observation into its north and west components. At the end of each of the Tables 9a to 9f are given the means without regard to surface direction. These are shown also in figure 17, except that here the annual values are omitted. The more prominent features are: The large increase in velocity in the first 500 meters above the surface; a more gradual increase at greater heights (in summer there is an actual decrease—most pronounced at southern stations); the decided seasonal variation in the upper levels; the seasonal lag, i. e., higher velocities in spring than in autumn; and the close approach to a westerly direction in the higher levels, this feature being most in evidence at the northern stations.

An examination of the detailed data given in Tables 9a to 9f indicates that the behavior of the free-air winds, when classified according to direction at the surface, is so nearly the same at the three northern stations and again at the three southern stations as to justify a regrouping of the results. This procedure finds further justification in the fact that certain irregularities here and there, due to paucity of observations, are thus in a large measure smoothed out. The rearrangement has been made in the following manner: (1) The average deviation of the wind at different levels from the surface direction has been determined for the three northern stations, the three southern stations, and for all six stations, the results being given in Tables 10a, 10b, and 10c, respectively. (2) For the same groups of stations the average increase with height (decrease in a few cases) in wind velocity from that at the surface has been computed, and the results are presented in Tables 11a, 11b, and 11c. (3) Finally the values in these two sets of tables have been combined and are given in Tables 12a, 12b, and 12c, respectively. In all cases only summer, winter, and annual means have been computed, but generally speaking the annual values fit quite closely those for spring and autumn also.

Average deviation.—Reference to Tables 10a to 10c shows that near the surface the turning of the winds is generally to the right, no matter what the surface direction may be. This turning is most pronounced with southerly surface winds, i. e., east through south to west-southwest, until at 3 to 4 kilometers it amounts on the average to somewhat more than 90°. With northerly winds, on the other hand, i. e., west-northwest through north to northeast or east-northeast, the turning is to the right but small in amount up to about 1 kilometer, and then changes to the left at higher levels. The deviation is greater in winter than in summer at all stations and is also greater at northern than at southern stations. In other words, the turning is most pronounced when and where the latitudinal temperature gradient is strongest and hence the prevailing westerlies best developed. It is to be noted that in general the amount of the deviation in the upper levels varies directly, or nearly so, as the angle between the surface direction and a westerly direction. For example, a surface southeasterly wind turns more than does a surface southerly wind—both becoming as a rule southwesterly or west-southwesterly in the upper levels.

Average velocity increase.—The figures in Tables 11a to 11c show that in the lower levels up to an altitude of about 1 kilometer the largest increases in velocity occur above surface southeasterly to southwesterly winds, but that at greater heights, i. e., 1½ to 4 kilometers (and presumably thence up to the base of the stratosphere) the largest increases are found above surface southwesterly to northwesterly winds. They are least in all seasons and at all heights above surface northeasterly to east-southeasterly winds.

Average actual directions and velocities.—Tables 12a to 12c contain actual wind directions and velocities, as determined from the values given in Tables 10a to 10c and 11a to 11c. The following points are brought out: (1) The seasonal variation in surface velocities is small; (2) there is also little variation in surface velocities with direction,

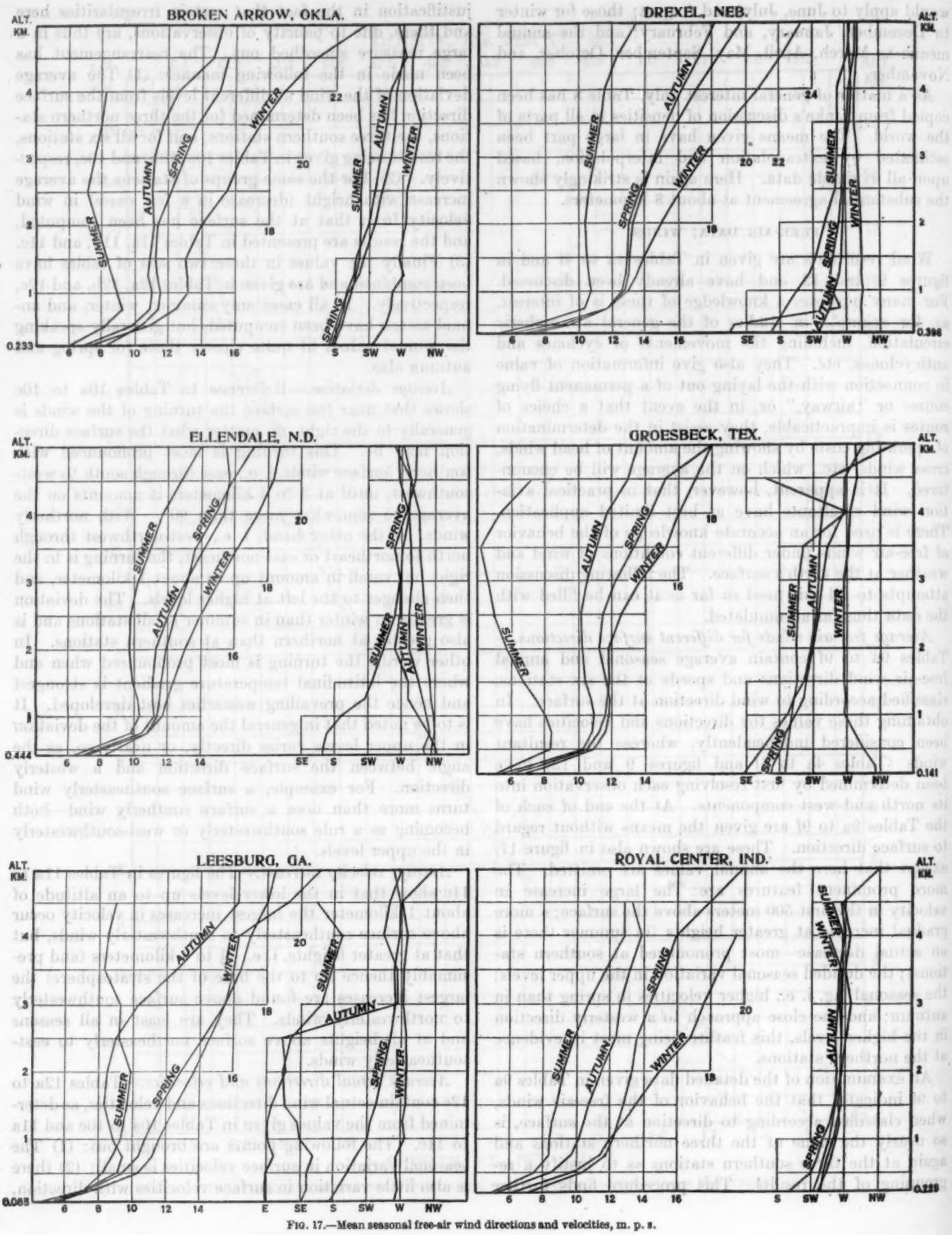


FIG. 17.—Mean seasonal free-air wind directions and velocities, m. p. s.

i. e., easterly winds are nearly as strong as are westerly winds; (3) above the surface all winds increase in speed up to an altitude of about 500 meters; on the average this increase amounts to about 100 per cent, but it is greater above westerly than above easterly winds; (4) at still higher levels easterly winds diminish, but westerly winds continue to increase; (5) coincident with these changes in free-air wind velocities there is a turning of the winds such that they approach very nearly a westerly direction, except that above northeasterly to easterly surface winds there is generally an east component up to at least the 4-kilometer level; and (6) the seasonal variation, slight at the surface, increases rapidly with altitude at both the northern and southern stations.

Frequency of free-air winds from different directions.—Tables 13a to 13f give the seasonal and annual percentage frequency of free-air winds from different directions at the six kite stations. Values for summer, winter, and the year at selected levels are shown also in figures 18 to 25. For convenience in contrasting summer and winter conditions the figures for those seasons at the selected levels appear side by side on the same page. Following these are given the figures showing conditions for the year. Arcs represent 5 per cent intervals.

The more striking features are: (1) The greater percentage of easterly winds at all levels in summer than in winter; (2) the pronounced south component in summer, especially at southern stations, and the equally pronounced north component in winter, especially at northern stations; (3) the resulting predominance of a south component at southern stations and of a north component at northern stations for the year; and (4) the very large west component at all stations for the year at 3 and 4 kilometers.

Clockwise and counterclockwise turning.—Tables 14a to 14f give for each station the average seasonal and annual percentage frequency of clockwise and counterclockwise turning of winds from surface direction. In Tables 15a to 15c these values for summer, winter, and the year have been regrouped in a manner similar to that employed in the preparation of Tables 10a to 12c, already described. The data in Tables 15a to 15c are supplementary to those given in Tables 10a to 10c. In the one case the percentage *frequency* of right and left turning is shown; in the other, the resultant average *amount* of the turning. The data in the tables may be briefly summarized as follows: (1) The tendency to clockwise turning is greater than that to counterclockwise for all directions near the surface but is most pronounced for southerly winds, i. e., east through south to west-southwest; (2) this tendency increases with altitude for these southerly winds and amounts to about 90 per cent at 3 to 4 kilometers; (3) with northerly winds the tendency to clockwise turning does not change much with altitude, but the tendency to counterclockwise turning, small near the surface, increases to 60 to 80 per cent at 3 to 4 kilometers; and (4) the turning is more pronounced, especially near the surface, in winter than in summer and at northern than at southern stations.

West component.—In Tables 16a to 16f may be found for the six stations the average seasonal and annual percentage frequency of a west component in winds at various levels classified according to surface direction. An inspection of these tables shows at once that above surface westerly winds, i. e., north-northwest to south-southwest, there is a west component in practically all cases. It has been possible therefore to leave these out in preparing the supplementary Tables 17a to 17c, whose arrangement is otherwise like that in Tables 10a to 10c, 11a to 11c, etc. The figures show that at heights of 3 to 4 kilometers a west component is more frequent than an east component above all surface easterly winds except those from northeast to east. The last line in each group of figures in Tables 17a to 17c gives the mean percentage frequency of a west component, when *all* surface directions are considered. The preponderance of a west over an east component at 3 to 4 kilometers is striking, the annual values for all stations being 89 per cent and 94 per cent, respectively. It is greater in winter than in summer and at northern than at southern stations.

North component.—The two groups of tables, 18a to 18f and 19a to 19c, which give percentage frequency of a north component in the winds, are similar in arrangement to the tables already discussed. In general, the data here presented indicate that a north or south component in the surface winds persists in a majority of cases in the upper levels, except that above a surface east-northeasterly wind a south component is the more frequent and above a southwesterly or a west-southwesterly wind a north component predominates. Other features brought out in these tables support the statements made in the discussion of Tables 13a to 13f and figures 18 to 25, viz, the pronounced south component in summer, especially at southern stations, the equally pronounced north component in winter, especially at northern stations, and the resulting predominance of a south component at southern stations and of a north component at northern stations for the year.

High wind velocities.—Table 20 gives the percentage frequency of free-air wind velocities 10 m. p. s. and over and 20 m. p. s. and over. The frequency increases, of course, with altitude, is greatest in winter and least in summer, and in general is greater at northern than at southern stations.

Table 21 shows the highest velocities that have been observed. In nearly all cases these occur with a westerly wind, usually between northwest and southwest.

General remarks.—The foregoing discussion of wind data and the conclusions given should be accepted with the reservation that they are based upon observations that were made only under conditions favorable for kite flying, i. e., surface winds ranging from 2 to 20 m. p. s. and upper winds ranging from 5 to 35 m. p. s. Thus it

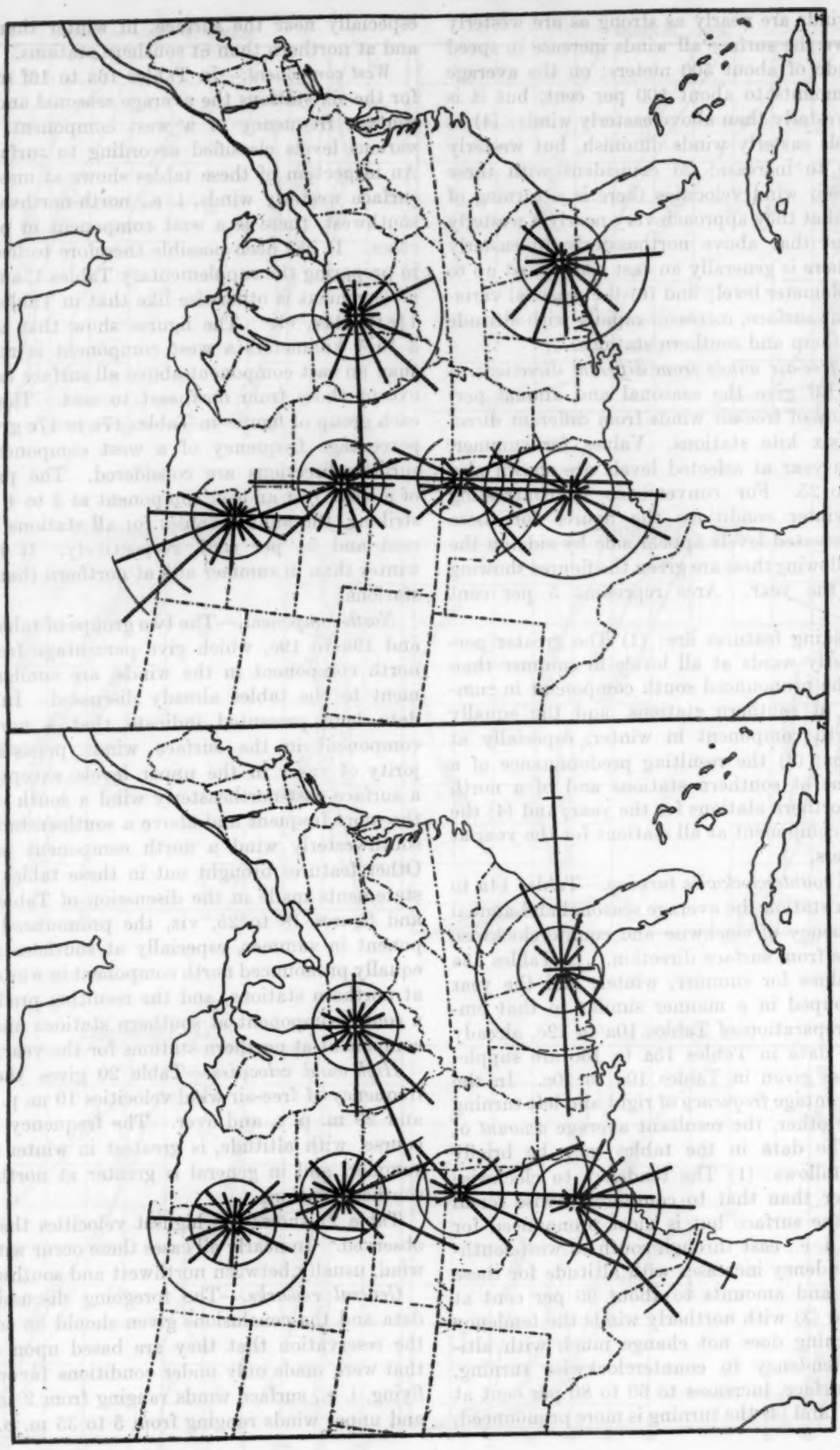


FIG. 18.—Percentage frequency of winds from different directions at the surface. Summer at left, winter at right.

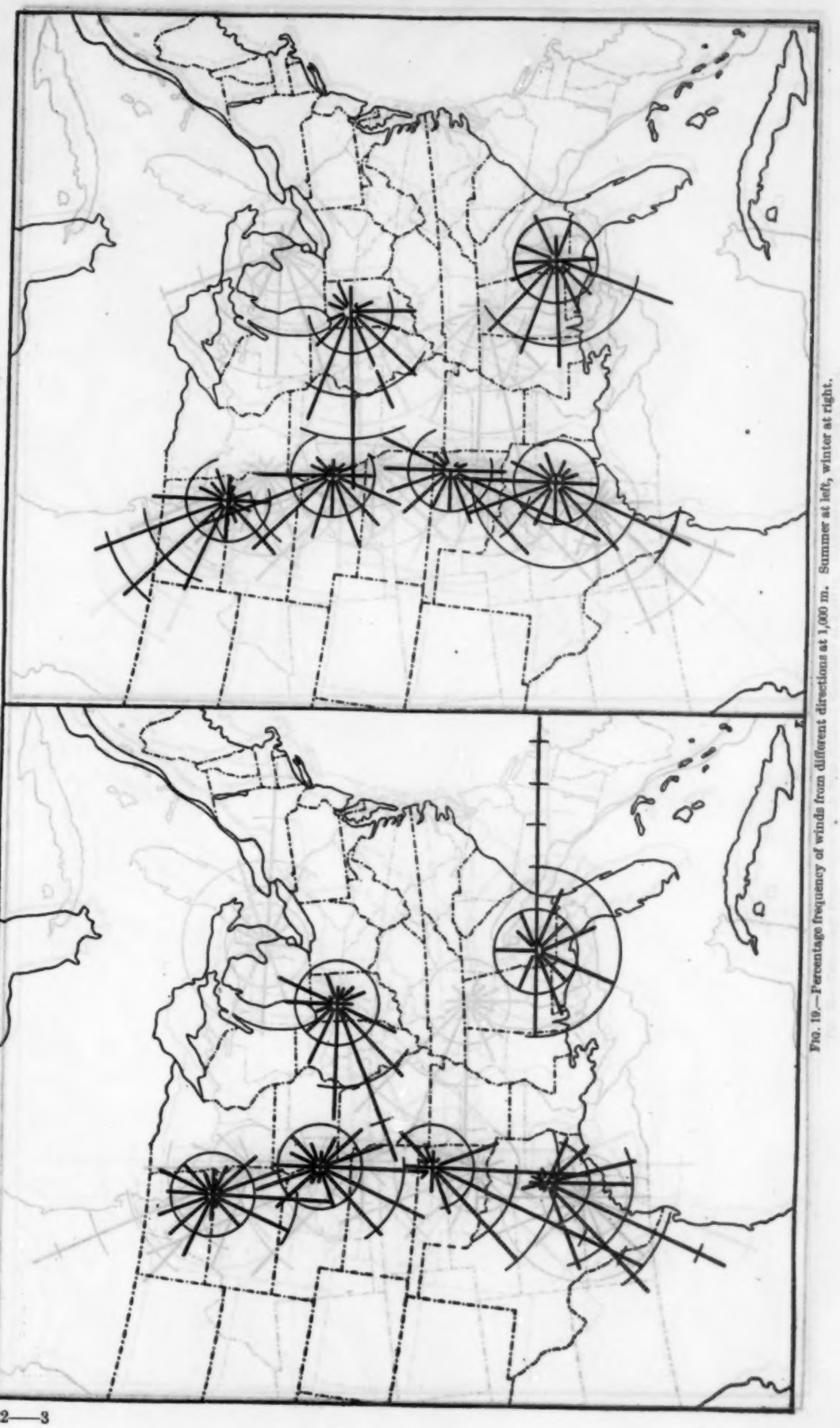


FIG. 19.—Percentage frequency of winds from different directions at 1,000 m. Summer at left, winter at right.

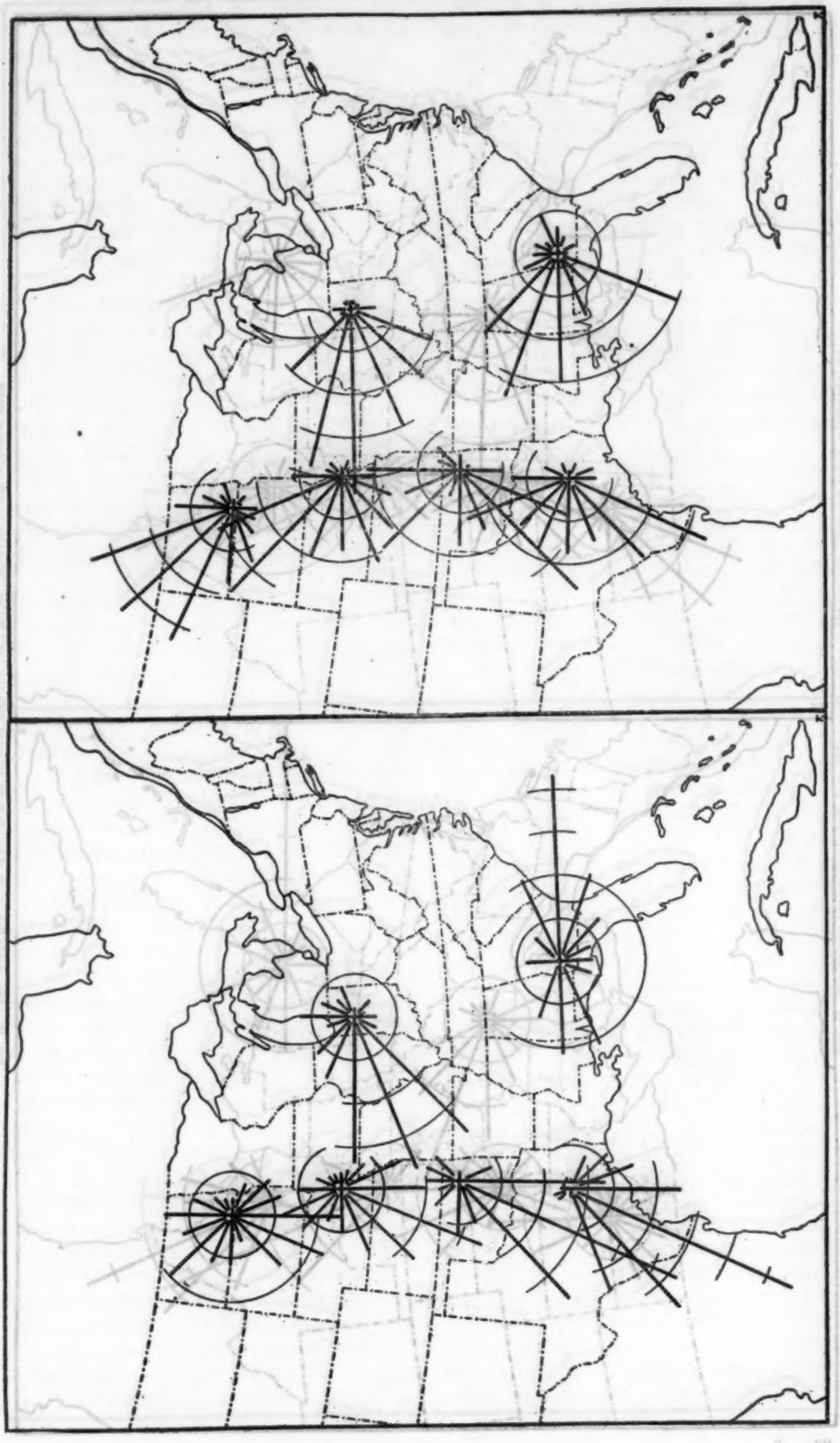


FIG. 20.—Percentage frequency of winds from different directions at 1,500 m. Summer at left, winter at right.

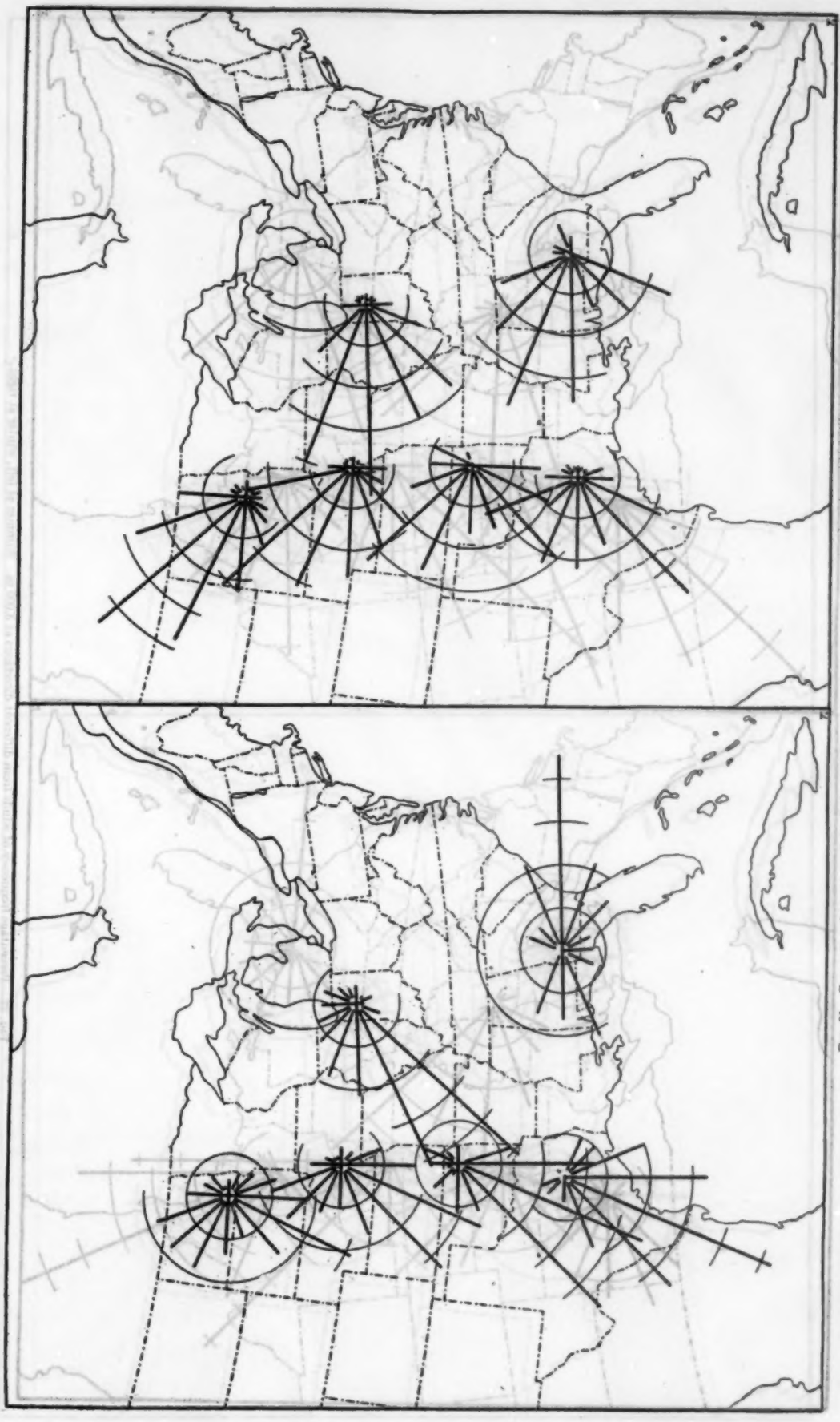


FIG. 21.—Percentage frequency of winds from different directions at 2,000 m. Summer at left, winter at right.

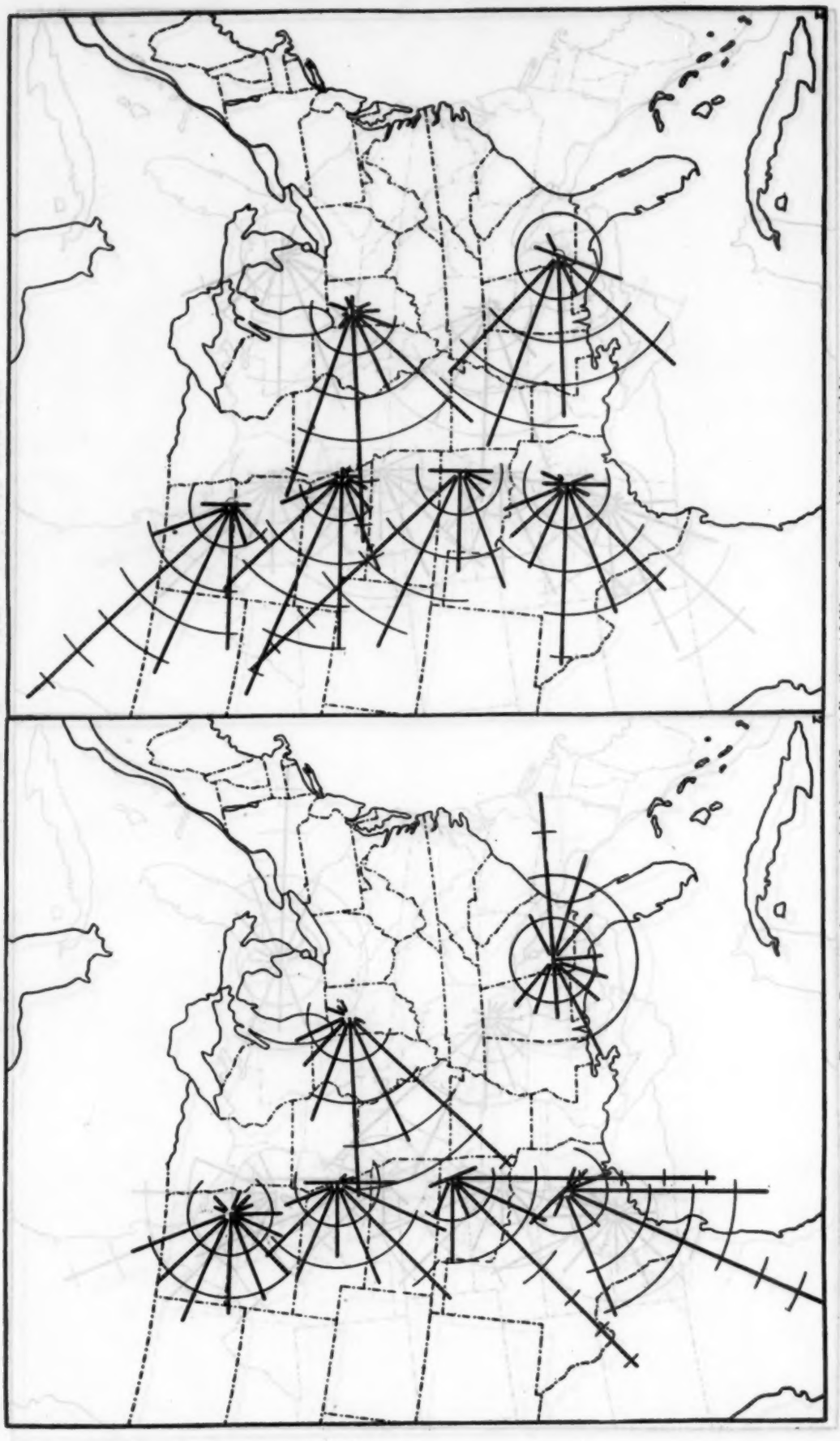


FIG. 22.—Percentage frequency of winds from different directions at 3,000 m. Summer at left, winter at right.

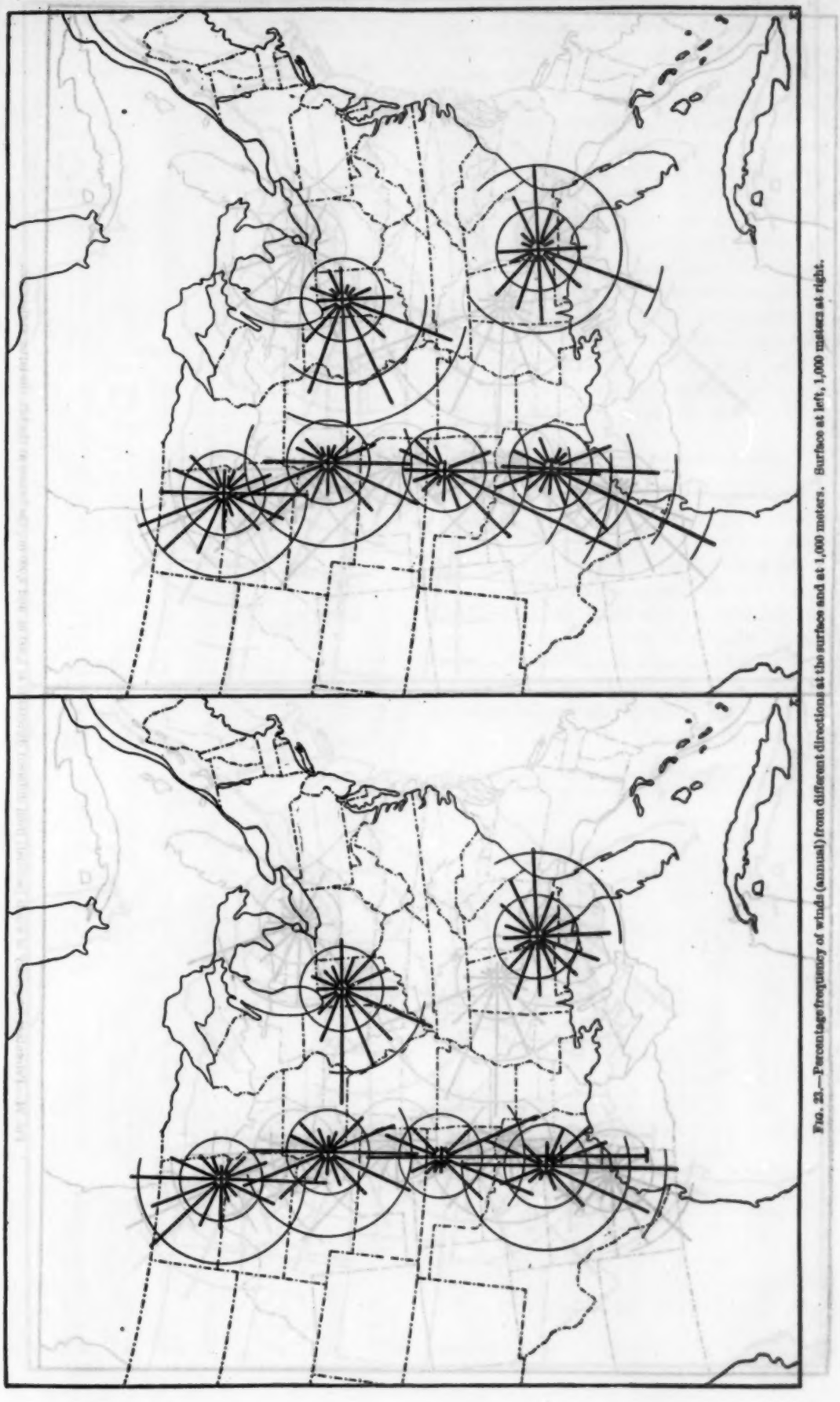


FIG. 23.—Percentage frequency of winds (annual) from different directions at the surface and at 1,000 meters. Surface at left, 1,000 meters at right.

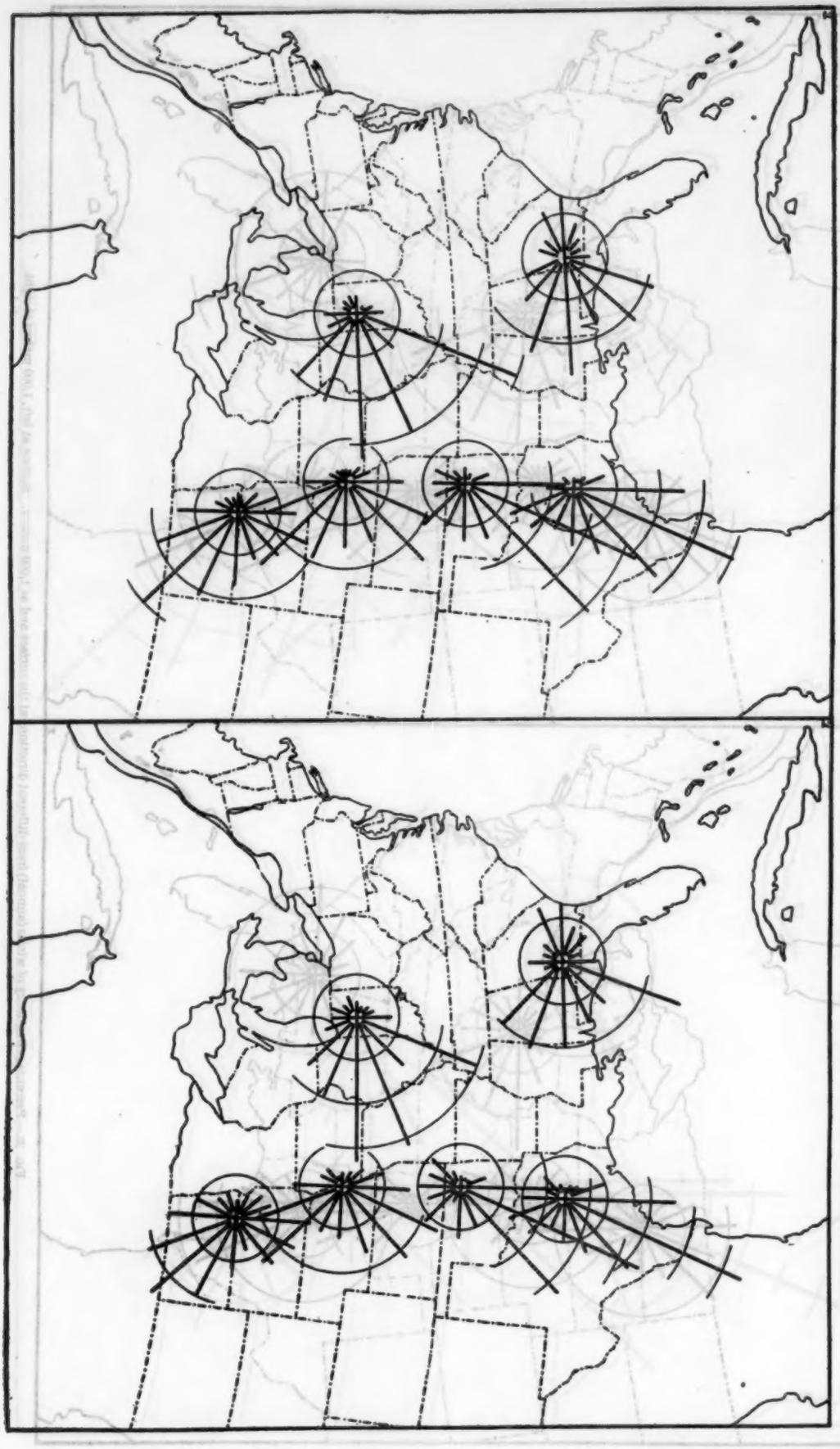


FIG. 24.—Percentage frequency of winds (annual) from different directions at 1,500 m. and 2,000 m., the former at the left, the latter at the right.

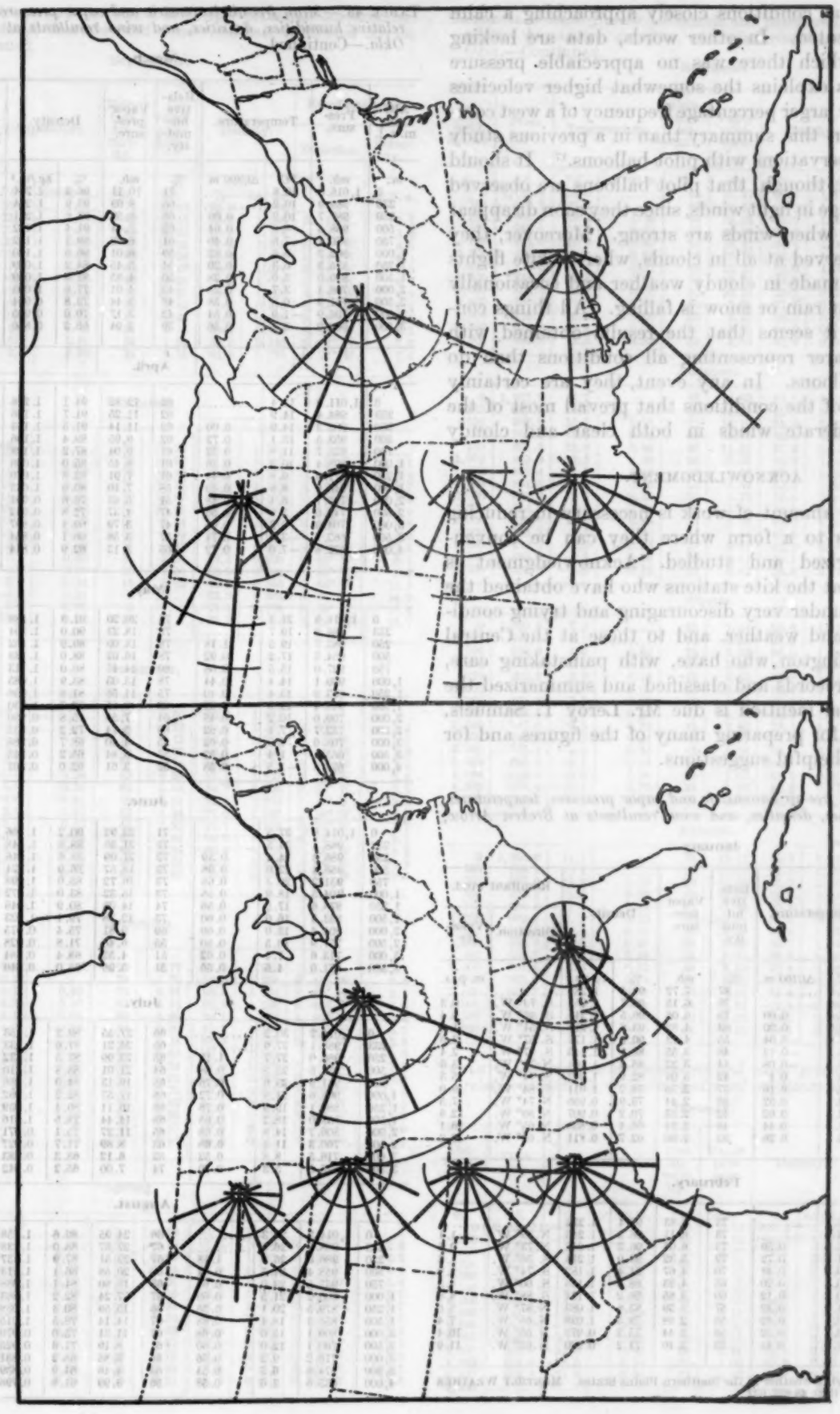


FIG. 25.—Percentage frequency of winds (annual) from different directions at 3,000 m. and 4,000 m., the former at left, the latter at right.

will be seen that conditions closely approaching a calm are not represented. In other words, data are lacking for days on which there was no appreciable pressure gradient. This explains the somewhat higher velocities and the slightly larger percentage frequency of a west component given in this summary than in a previous study based upon observations with pilot balloons.[17] It should be remembered, though, that pilot balloons are observed to best advantage in light winds, since they soon disappear in the distance when winds are strong. Moreover, they can not be observed at all in clouds, whereas kite flights are frequently made in cloudy weather and occasionally even when light rain or snow is falling. All things considered, then, it seems that the results obtained with kites come nearer representing all conditions than do those with balloons. In any event, they are certainly representative of the conditions that prevail most of the time, viz, moderate winds in both clear and cloudy weather.

ACKNOWLEDGMENT.

An immense amount of work is necessary in reducing free-air records to a form where they can be conveniently summarized and studied. Acknowledgment is made to those at the kite stations who have obtained the records, often under very discouraging and trying conditions of wind and weather, and to those at the Central Office in Washington who have, with painstaking care, computed the records and classified and summarized the results. Special mention is due Mr. Leroy T. Samuels, first assistant, for preparing many of the figures and for offering many helpful suggestions.

TABLE 4a.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Broken Arrow, Okla.*

January.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m³*		*m. p. s.*
0	1,023.6	3.8	.....	87	7.72	90.4	1.285	.....	.....
233	994.7	3.4	.....	76	6.15	96.7	1.251	S. 79° W.	0.3
250	992.6	3.4	0.00	75	6.06	96.5	1.248	S. 46° W.	0.4
500	962.3	2.9	0.20	63	4.82	93.8	1.213	S. 54° W.	1.1
750	933.0	3.0	−0.04	55	4.13	90.9	1.176	S. 57° W.	2.0
1,000	905.0	3.3	−0.12	48	3.55	88.1	1.140	S. 87° W.	2.4
1,250	877.6	3.5	−0.08	44	3.22	85.4	1.104	N. 74° W.	3.3
1,500	851.1	3.2	0.12	42	3.04	82.9	1.072	S. 74° W.	5.3
2,000	800.1	2.4	0.16	37	2.75	78.2	1.011	S. 84° W.	9.0
2,500	751.9	0.8	0.32	36	2.44	73.9	0.956	N. 74° W.	7.5
3,000	706.1	−2.3	0.62	42	2.33	70.2	0.907	N. 59° W.	12.8
3,500	663.3	−4.5	0.44	48	2.34	66.4	0.858	N. 65° W.	16.1
4,000	622.7	−5.8	0.26	35	1.66	62.7	0.811	N. 68° W.	19.3

February.

0	1,020.3	5.7	.....	73	6.83	93.4	1.272	.....	.....
233	991.6	3.7	.....	73	6.11	96.3	1.245	N. 49° W.	1.1
250	989.5	3.6	0.59	73	6.06	96.2	1.243	N. 73° W.	0.8
500	959.4	1.8	0.72	72	5.32	93.9	1.214	S. 56° W.	1.3
750	930.1	0.0	0.48	70	4.67	91.4	1.182	S. 74° W.	2.9
1,000	901.5	0.1	0.20	65	4.23	88.8	1.148	S. 60° W.	4.3
1,250	873.9	−0.2	0.12	60	3.85	86.2	1.114	S. 88° W.	4.6
1,500	847.1	−1.0	0.32	57	3.39	83.8	1.083	N. 87° W.	5.0
2,000	795.9	−3.1	0.42	56	2.88	79.3	1.026	N. 68° W.	7.4
2,500	747.1	−5.7	0.52	56	2.44	75.2	0.973	N. 65° W.	10.4
3,000	700.9	−7.9	0.44	53	2.10	71.2	0.920	N. 63° W.	11.9

[17] Reihle, J. A. Flying weather in the Southern Plains States. MONTHLY WEATHER REVIEW, November, 1920, 48:627–632.

TABLE 4a.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Broken Arrow, Okla.*—Continued.

March.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m³*		*m. p. s.*
0	1,018.0	10.8	.....	71	10.11	96.2	1.244	.....	.....
233	989.9	10.2	.....	66	8.69	93.9	1.214	S. 12° E.	3.1
250	987.7	10.2	0.00	66	8.59	93.6	1.211	S. 11° E.	3.5
500	958.5	8.6	0.64	63	7.44	91.4	1.182	S. 2° W.	5.4
750	930.1	7.6	0.40	61	6.62	89.1	1.152	S. 2° W.	7.6
1,000	902.2	6.8	0.32	59	6.01	86.6	1.120	S. 14° W.	8.3
1,250	875.3	6.3	0.20	54	5.45	84.2	1.089	S. 22° W.	9.3
1,500	849.0	5.6	0.28	50	4.85	81.9	1.059	S. 36° W.	6.4
2,000	798.4	3.7	0.38	43	4.01	77.6	1.003	S. 61° W.	5.9
2,500	751.3	0.8	0.58	43	3.44	73.8	0.954	S. 64° W.	8.0
3,000	705.9	−1.9	0.54	42	3.17	70.0	0.905	S. 84° W.	10.2
3,500	662.9	−3.7	0.36	39	2.94	66.2	0.856	S. 69° W.	10.9

April.

0	1,011.9	15.4	.....	62	12.82	94.1	1.216	.....	.....
233	984.4	14.9	.....	62	11.25	91.7	1.186	S. 7° W.	2.9
250	982.2	14.9	0.00	62	11.14	91.5	1.183	S. 9° W.	2.9
500	953.5	13.1	0.72	62	9.95	89.4	1.156	S. 15° W.	4.2
750	925.7	11.8	0.52	61	9.04	87.2	1.128	S. 20° W.	5.5
1,000	898.4	10.9	0.36	61	8.45	85.0	1.098	S. 27° W.	6.6
1,250	871.9	9.8	0.44	61	7.91	82.8	1.070	S. 40° W.	7.2
1,500	846.0	8.8	0.40	58	7.10	80.6	1.043	S. 49° W.	7.8
2,000	796.7	6.4	0.48	51	5.43	76.6	0.991	S. 58° W.	9.1
2,500	749.6	3.6	0.56	47	4.37	72.8	0.942	S. 63° W.	10.8
3,000	704.9	0.3	0.66	47	3.79	69.4	0.897	S. 68° W.	10.7
3,500	662.7	−3.4	0.74	57	3.58	66.1	0.854	S. 73° W.	14.7
4,000	622.6	−7.0	0.72	65	3.13	62.9	0.814	S. 64° W.	15.5

May.

0	1,011.8	21.4	.....	78	20.20	91.9	1.188	.....	.....
233	984.9	19.7	.....	78	18.23	90.0	1.164	S. 37° E.	2.9
250	982.7	19.5	1.18	78	18.09	89.9	1.162	S. 39° E.	2.8
500	954.5	17.2	0.92	78	16.02	88.0	1.138	S. 35° E.	3.1
750	927.0	15.5	0.68	80	14.47	86.0	1.113	S. 14° E.	3.2
1,000	900.1	14.4	0.44	78	13.03	83.9	1.085	S. 4° W.	3.8
1,250	873.9	13.4	0.40	75	11.58	81.8	1.058	S. 25° W.	3.9
1,500	848.4	12.6	0.32	69	9.85	79.7	1.030	S. 40° W.	4.3
2,000	799.6	10.2	0.48	64	7.56	75.8	0.980	S. 55° W.	4.3
2,500	752.7	7.1	0.62	60	5.74	72.2	0.933	S. 72° W.	5.2
3,000	708.0	4.0	0.62	55	4.40	68.7	0.888	S. 87° W.	6.4
3,500	665.4	1.4	0.52	53	3.84	65.2	0.843	N. 80° W.	8.2
4,000	625.8	−1.5	0.58	52	3.61	62.0	0.801	N. 45° W.	18.7

June.

0	1,014.8	27.5	.....	71	23.92	90.2	1.166	.....	.....
233	988.4	24.5	.....	72	21.36	88.8	1.148	S. 6° E.	3.2
250	986.3	24.4	0.59	72	21.09	88.6	1.146	S. 6° E.	3.3
500	958.4	22.0	0.96	73	18.57	86.9	1.124	S. 6° W.	4.5
750	931.2	20.3	0.68	73	16.72	85.0	1.098	S. 11° W.	5.2
1,000	904.5	18.9	0.56	73	15.32	83.0	1.072	S. 22° W.	5.2
1,250	878.6	17.5	0.56	74	14.03	80.9	1.046	S. 25° W.	5.5
1,500	853.3	16.0	0.60	73	12.58	79.1	1.023	S. 33° W.	5.7
2,000	804.4	13.0	0.60	69	9.81	75.4	0.975	S. 38° W.	6.5
2,500	757.9	10.5	0.50	55	6.46	71.8	0.928	S. 29° W.	6.9
3,000	713.6	7.4	0.62	51	4.52	68.4	0.884	S. 4° W.	7.9
3,500	671.0	4.6	0.56	51	3.96	65.0	0.840	S. 7° W.	11.5

July.

0	1,014.2	30.3	.....	66	27.55	89.2	1.153	.....	.....
233	988.1	27.9	.....	65	24.21	87.6	1.133	S. 11° W.	3.3
250	986.0	27.7	1.18	65	23.99	87.5	1.132	S. 12° W.	3.4
500	958.6	25.5	0.88	64	21.01	85.8	1.110	S. 19° W.	4.5
750	931.9	23.6	0.76	65	19.13	84.0	1.086	S. 28° W.	4.9
1,000	905.6	21.8	0.72	66	17.57	82.2	1.062	S. 32° W.	4.6
1,250	880.1	19.9	0.76	68	16.11	80.4	1.039	S. 32° W.	4.5
1,500	855.0	18.2	0.68	68	14.44	78.6	1.016	S. 32° W.	4.5
2,000	806.7	14.8	0.68	65	11.27	75.1	0.971	S. 29° W.	3.8
2,500	760.3	11.4	0.68	63	8.89	71.7	0.927	S. 28° W.	4.6
3,000	716.5	8.8	0.52	52	6.12	68.3	0.883	S. 30° W.	6.6
3,500	675.5	5.3	0.70	74	7.00	65.2	0.842	S. 27° W.	6.6

August.

0	1,014.3	29.3	.....	66	24.95	89.6	1.158	.....	.....
233	988.0	26.8	.....	67	22.67	88.0	1.138	S. 7° E.	3.3
250	986.0	26.6	1.18	67	22.51	87.9	1.137	S. 9° E.	3.4
500	958.4	24.5	0.84	68	20.58	86.1	1.113	S. 4° W.	4.6
750	931.5	23.0	0.60	68	18.80	84.1	1.088	S. 13° W.	5.0
1,000	905.2	21.5	0.60	67	17.24	82.2	1.063	S. 24° W.	5.7
1,250	879.5	20.1	0.56	66	15.59	80.3	1.038	S. 33° W.	5.6
1,500	854.3	18.4	0.68	67	14.14	78.5	1.015	S. 38° W.	5.5
2,000	806.1	15.0	0.68	67	11.31	75.0	0.970	S. 44° W.	5.7
2,500	760.1	12.0	0.60	61	8.19	71.6	0.925	S. 52° W.	7.0
3,000	716.2	9.2	0.56	54	5.85	68.2	0.881	S. 51° W.	8.6
3,500	674.6	6.5	0.54	53	4.46	64.9	0.839	S. 34° W.	9.4
4,000	635.6	3.6	0.58	56	3.99	61.8	0.798	S. 42° W.	11.6

TABLE 4a.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Broken Arrow, Okla.*—Continued.

September.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,014.9	25.1	.....	71	21.60	91.0	1.176	.....	.....
233	988.3	22.8	.....	69	19.44	89.3	1.155	S. 1° E.	3.1
250	986.3	22.5	1.76	69	19.32	89.3	1.154	S.	3.2
500	958.3	20.5	0.80	68	17.13	87.4	1.120	S. 8° W.	4.6
750	931.0	19.1	0.56	66	15.14	85.4	1.104	S. 16° W.	5.4
1,000	904.3	17.9	0.48	63	13.47	83.3	1.077	S. 19° W.	5.0
1,250	878.2	16.5	0.56	63	11.95	81.3	1.051	S. 22° W.	4.8
1,500	852.9	15.2	0.52	60	10.37	79.4	1.026	S. 35° W.	4.9
2,000	804.1	13.0	0.44	52	7.40	75.5	0.976	S. 44° W.	7.1
2,500	757.7	10.5	0.50	39	4.23	71.8	0.929	S. 49° W.	5.0
3,000	714.0	8.1	0.48	31	2.19	68.4	0.884	S. 23° W.	6.4
3,500	672.5	5.6	0.50	32	1.69	65.0	0.840	S. 7° W.	7.6
4,000	632.1	2.6	0.60	34	1.15	61.8	0.798	S. 22° W.	7.3

October.

0	1,016.7	19.5	.....	74	16.30	93.1	1.204	.....	.....
233	989.5	17.7	.....	72	14.97	91.2	1.179	S. 6° E.	3.1
250	987.5	17.6	0.50	72	14.85	91.0	1.177	S. 6° E.	3.4
500	959.0	16.0	0.64	70	13.26	88.9	1.150	S. 2° W.	4.7
750	931.2	14.9	0.44	69	12.07	86.7	1.121	S. 8° W.	5.6
1,000	904.1	13.9	0.40	65	10.81	84.5	1.093	S. 12° W.	5.9
1,250	877.8	13.0	0.36	61	9.64	82.4	1.065	S. 20° W.	5.8
1,500	852.1	12.0	0.40	58	8.52	80.3	1.038	S. 28° W.	5.9
2,000	803.0	9.9	0.42	45	5.45	76.3	0.986	S. 37° W.	7.6
2,500	755.9	7.4	0.50	31	3.05	72.5	0.938	S. 46° W.	8.1
3,000	711.1	4.9	0.50	21	1.54	68.9	0.891	S. 58° W.	9.2
3,500	668.9	2.2	0.54	16	0.62	65.5	0.846	S. 64° W.	12.5
4,000	628.7	−0.5	0.54	8	.....	62.2	0.804	S. 69° W.	14.0
4,500	590.7	−3.8	0.66	8	.....	59.1	0.764	N. 89° W.	16.4
5,000	554.0	−7.4	0.72	10	.....	56.2	0.727	S. 85° W.	15.7

November.

0	1,020.3	10.0	.....	73	9.50	96.8	1.251	.....	.....
233	992.0	8.5	.....	71	8.22	94.6	1.224	S. 50° W.	0.5
250	989.9	8.4	0.59	71	8.12	94.5	1.222	S. 33° W.	0.5
500	960.3	7.1	0.52	68	7.29	92.1	1.191	S. 7° W.	1.8
750	931.5	6.2	0.36	67	6.78	89.6	1.159	S. 7° W.	2.4
1,000	903.5	5.6	0.24	65	6.38	87.1	1.127	S. 18° W.	2.9
1,250	876.3	5.0	0.24	61	5.88	84.7	1.095	S. 32° W.	3.9
1,500	850.0	4.4	0.24	58	5.31	82.4	1.065	S. 47° W.	3.8
2,000	799.2	2.9	0.30	52	4.34	77.9	1.007	S. 59° W.	6.9
2,500	751.4	1.3	0.32	46	3.35	73.7	0.953	S. 71° W.	7.7
3,000	706.2	−0.9	0.44	45	2.94	69.8	0.903	S. 67° W.	9.7
3,500	663.6	−3.9	0.60	44	2.34	66.4	0.858	S. 88° W.	8.2
4,000	623.3	−6.5	0.52	37	1.56	63.0	0.814	S. 84° W.	13.8
4,500	584.8	−8.9	0.48	32	1.07	59.6	0.771	N. 67° W.	28.5

December.

0	1,017.9	6.5	.....	79	7.77	97.8	1.265	.....	.....
233	989.3	5.2	.....	73	6.79	95.6	1.236	S. 41° W.	1.9
250	917.3	5.1	0.59	73	6.71	95.4	1.234	S. 40° W.	2.1
500	957.4	4.2	0.36	67	5.70	92.8	1.200	S. 48° W.	4.4
750	928.4	4.1	0.04	60	4.89	90.1	1.165	S. 49° W.	5.7
1,000	900.3	4.8	−0.28	50	3.99	87.2	1.127	S. 60° W.	6.1
1,250	873.2	4.9	−0.04	43	3.43	84.5	1.093	S. 80° W.	5.8
1,500	846.9	4.3	0.24	40	3.04	82.2	1.062	W.	5.8
2,000	796.5	2.3	0.40	34	2.34	77.9	1.007	N. 81° W.	7.3
2,500	748.5	−0.1	0.48	32	1.91	73.8	0.954	S. 89° W.	10.6
3,000	702.9	−2.8	0.54	33	1.78	70.0	0.905	N. 79° W.	13.8
3,500	659.7	−5.2	0.48	31	1.62	66.3	0.857	N. 79° W.	16.5
4,000	618.8	−7.7	0.50	30	1.53	62.8	0.812	N. 82° W.	14.8
4,500	579.1	−11.2	0.70	30	1.47	59.5	0.770	N. 80° W.	17.0
5,000	542.6	−14.6	0.68	31	1.43	56.5	0.731	N. 68° W.	17.0

Spring.

0	1,013.9	15.9	.....	70	14.38	94.0	1.216	.....	.....
233	986.4	14.9	.....	69	12.72	91.9	1.188	S. 12° E.	2.9
250	984.2	14.8	0.59	69	12.60	91.7	1.185	S. 12° E.	2.9
500	955.5	12.9	0.76	68	11.13	89.6	1.159	S. 1° E.	4.1
750	927.6	11.6	0.52	68	10.04	87.4	1.131	S. 5° W.	5.4
1,000	900.2	10.7	0.36	67	9.16	85.2	1.101	S. 17° W.	6.1
1,250	873.7	9.8	0.36	64	8.31	83.0	1.072	S. 30° W.	6.7
1,500	847.8	9.0	0.32	60	7.26	80.8	1.044	S. 43° W.	6.6
2,000	798.2	6.8	0.44	54	5.66	76.6	0.991	S. 58° W.	6.5
2,500	751.2	3.9	0.58	51	4.51	72.9	0.943	S. 65° W.	8.2
3,000	706.3	0.9	0.60	49	3.78	69.4	0.897	S. 77° W.	8.4
3,500	663.7	−1.8	0.54	51	3.45	65.8	0.851	S. 81° W.	11.3
4,000	623.9	−5.0	0.64	55	3.11	62.6	0.810	S. 78° W.	14.6

TABLE 4a.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Broken Arrow, Okla.*—Continued.

Summer.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,014.4	29.0	.....	68	25.47	89.6	1.159	.....	.....
233	988.2	26.4	.....	68	22.75	88.2	1.140	S. 1° E.	3.2
250	986.1	26.2	1.18	68	22.53	88.0	1.138	S. 2° E.	3.3
500	958.5	24.0	0.88	68	20.05	86.3	1.116	S. 9° W.	4.6
750	931.6	22.3	0.68	68	18.21	84.4	1.091	S. 17° W.	5.0
1,000	905.2	20.7	0.64	68	16.70	82.5	1.066	S. 25° W.	5.3
1,250	879.5	19.1	0.64	69	15.23	80.6	1.042	S. 30° W.	5.2
1,500	854.3	17.5	0.64	69	13.71	78.8	1.018	S. 35° W.	5.2
2,000	805.8	14.2	0.66	67	10.79	75.2	0.972	S. 39° W.	5.5
2,500	759.5	11.2	0.60	60	7.84	71.7	0.927	S. 37° W.	6.1
3,000	715.5	8.4	0.56	53	5.49	68.3	0.883	S. 31° W.	7.5
3,500	673.8	5.4	0.60	60	5.13	65.0	0.841	S. 23° W.	9.5
4,000	634.8	2.5	0.58	63	4.66	61.9	0.800	S. 32° W.	11.0

Autumn.

0	1,017.3	18.2	.....	73	15.80	93.6	1.210	.....	.....
233	989.9	16.3	.....	71	14.21	91.7	1.185	S.	2.1
250	987.9	16.1	1.18	71	14.10	91.6	1.184	S. 1° E.	2.3
500	959.2	14.5	0.64	69	12.56	89.4	1.157	S. 5° W.	3.6
750	931.2	13.4	0.44	68	11.33	87.2	1.127	S. 9° W.	4.4
1,000	903.9	12.5	0.36	65	10.22	84.9	1.098	S. 14° W.	4.5
1,250	877.4	11.5	0.40	62	9.16	82.8	1.070	S. 24° W.	4.8
1,500	851.6	10.5	0.40	59	8.07	80.6	1.043	S. 35° W.	4.9
2,000	802.0	8.6	0.38	50	5.73	76.5	0.989	S. 46° W.	7.1
2,500	754.9	6.4	0.44	39	3.54	72.7	0.940	S. 56° W.	7.0
3,000	710.3	4.0	0.48	33	2.22	69.0	0.892	S. 60° W.	8.1
3,500	668.2	1.3	0.54	31	1.55	65.6	0.848	S. 67° W.	9.6
4,000	627.9	−1.5	0.56	27	0.87	62.3	0.805	S. 76° W.	13.0
4,500	589.7	−4.3	0.56	25	0.51	59.1	0.764	N. 83° W.	17.3
5,000	553.0	−7.9	0.72	27	0.42	56.2	0.726	S. 85° W.	15.7

Winter.

0	1,020.6	5.3	.....	80	7.44	98.6	1.274	.....	.....
233	991.9	4.1	.....	74	6.35	96.2	1.244	S. 63° W.	1.0
250	989.8	4.0	0.59	74	6.28	96.0	1.242	S. 52° W.	1.1
500	959.7	2.9	0.44	68	5.28	93.5	1.209	S. 50° W.	2.7
750	930.5	2.5	0.16	62	4.56	90.8	1.174	S. 56° W.	3.9
1,000	902.3	2.7	−0.08	55	3.92	88.0	1.138	S. 64° W.	4.6
1,250	874.9	2.7	0.00	50	3.50	85.4	1.104	S. 87° W.	4.7
1,500	848.5	2.1	0.24	47	3.16	83.0	1.072	S. 88° W.	5.4
2,000	797.6	0.5	0.32	43	2.66	78.4	1.014	N. 81° W.	7.6
2,500	749.3	−1.7	0.44	42	2.27	74.3	0.960	N. 80° W.	9.7
3,000	703.4	−4.4	0.54	43	2.08	70.4	0.911	N. 70° W.	12.8
3,500	660.4	−6.7	0.46	45	2.00	66.7	0.862	N. 65° W.	16.3
4,000	619.6	−8.6	0.38	38	1.62	63.0	0.815	N. 78° W.	15.7
4,500	579.9	−12.1	0.70	38	1.56	59.8	0.773	N. 80° W.	17.0
5,000	543.4	−15.5	0.68	39	1.52	56.7	0.734	N. 68° W.	17.0

Annual.

0	1,016.6	17.1	.....	73	15.77	93.8	1.213	.....	.....
233	989.1	15.4	.....	70	14.01	91.9	1.188	S. 1° W.	2.1
250	987.0	15.3	0.59	70	13.88	91.7	1.186	S. 1° W.	2.3
500	958.2	13.6	0.68	68	12.26	89.6	1.159	S. 11° W.	3.6
750	930.2	12.5	0.44	66	11.04	87.4	1.130	S. 18° W.	4.4
1,000	902.9	11.7	0.32	63	10.01	85.1	1.100	S. 27° W.	4.8
1,250	876.4	10.9	0.32	61	9.06	82.8	1.071	S. 38° W.	5.1
1,500	850.6	9.9	0.40	59	8.06	80.7	1.044	S. 47° W.	5.1
2,000	801.0	7.6	0.46	54	6.22	76.6	0.991	S. 57° W.	6.2
2,500	753.8	5.0	0.52	48	4.55	72.8	0.942	S. 63° W.	7.0
3,000	709.0	2.3	0.54	44	3.40	69.2	0.895	S. 70° W.	7.9
3,500	666.7	−0.4	0.54	46	3.01	65.8	0.850	S. 74° W.	9.5
4,000	626.6	−3.1	0.54	44	2.52	62.4	0.807	S. 74° W.	12.7
4,500	587.9	−6.2	0.62	42	2.26	59.2	0.766	N. 85° W.	16.9
5,000	551.3	−9.7	0.70	44	2.20	56.1	0.725	N. 89° W.	15.7

TABLE 4b.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Drexel, Nebr.*

January.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,022.2	−6.6	.....	92	3.83	103.2	1.335	.....	.....
396	971.6	−6.8	.....	82	3.24	98.2	1.270	N. 73° W.	1.8
500	958.8	−6.8	0.00	79	3.07	96.9	1.253	N. 69° W.	2.8
750	928.6	−6.6	−0.08	73	2.74	93.8	1.213	N. 66° W.	4.8
1,000	899.3	−5.5	−0.44	67	2.59	90.5	1.170	N. 68° W.	6.3
1,250	871.1	−4.8	−0.28	63	2.48	87.4	1.130	N. 67° W.	7.4
1,500	843.9	−4.8	0.00	61	2.37	84.7	1.095	N. 66° W.	7.0
2,000	791.9	−5.8	0.20	59	2.11	79.8	1.032	N. 68° W.	11.1
2,500	743.0	−7.8	0.40	58	1.81	75.4	0.975	N. 75° W.	13.2
3,000	696.8	−10.2	0.48	59	1.56	71.4	0.923	N. 73° W.	15.5
3,500	653.0	−12.5	0.46	58	1.31	67.5	0.873	N. 76° W.	15.9
4,000	611.6	−15.0	0.50	56	1.08	63.8	0.825	N. 83° W.	17.8
4,500	572.8	−17.8	0.56	57	0.96	60.4	0.781	N. 81° W.	18.9
5,000	.....	.....	.....	.....	.....	.....	.....	W.	18.9

TABLE 4b.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Drexel, Nebr.*—Con.

February.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,020.8	−3.2	.....	87	4.39	101.5	1.313	.....	.....
396	970.9	−4.6	.....	79	3.78	97.3	1.258	N. 56° W.	1.4
500	958.2	−5.0	0.38	77	3.60	96.2	1.244	N. 64° W.	2.0
750	928.2	−5.3	0.12	73	3.25	93.3	1.206	N. 67° W.	4.1
1,000	899.0	−4.7	−0.24	68	3.06	90.2	1.166	N. 64° W.	5.7
1,250	870.9	−4.0	−0.28	63	2.90	87.1	1.127	N. 63° W.	6.7
1,500	843.8	−4.0	0.00	59	2.65	84.4	1.091	N. 66° W.	8.9
2,000	792.0	−4.9	0.18	54	2.22	79.5	1.028	N. 68° W.	11.0
2,500	743.1	−7.0	0.42	52	1.83	75.2	0.972	N. 70° W.	13.1
3,000	697.1	−9.4	0.48	53	1.51	71.2	0.920	N. 73° W.	15.1
3,500	653.7	−12.2	0.56	53	1.19	67.5	0.873	N. 71° W.	16.7
4,000	612.7	−15.1	0.58	51	0.88	64.0	0.827	N. 77° W.	16.7
4,500	575.1	−18.8	0.74	55	0.74	60.9	0.788	N. 81° W.	18.5
5,000	538.5	−22.7	0.78	55	0.61	58.0	0.749	N. 76° W.	19.7

March.

0	1,015.4	6.7	.....	70	6.58	97.6	1.262	.....	.....
396	967.4	4.3	.....	66	5.40	93.8	1.213	S. 33° W.	1.0
500	955.1	3.7	0.58	65	5.10	92.8	1.200	S. 37° W.	1.1
750	926.0	2.8	0.36	63	4.56	90.3	1.167	S. 68° W.	2.4
1,000	897.7	2.3	0.20	60	4.09	87.7	1.134	S. 77° W.	3.3
1,250	870.4	2.1	0.08	55	3.73	85.1	1.100	S. 86° W.	4.0
1,500	843.9	1.6	0.20	52	3.36	82.7	1.069	S. 83° W.	5.1
2,000	793.0	−0.4	0.40	50	2.81	78.3	1.012	S. 86° W.	6.6
2,500	744.9	−3.0	0.52	50	2.37	74.2	0.960	S. 84° W.	9.1
3,000	699.5	−5.8	0.56	52	2.01	70.4	0.911	W.	11.7
3,500	656.4	−8.6	0.56	52	1.69	66.8	0.864	N. 84° W.	14.8
4,000	615.7	−11.2	0.52	52	1.49	63.3	0.819	N. 80° W.	18.4
4,500	576.7	−15.6	0.88	73	1.39	60.3	0.780	N. 82° W.	17.3
5,000	539.7	−19.0	0.68	66	0.77	57.2	0.740	N. 68° W.	13.8

April.

0	1,014.3	10.8	.....	66	8.20	96.0	1.241	.....	.....
396	967.0	7.8	.....	66	7.05	92.2	1.192	N. 59° E.	0.9
500	954.7	7.0	0.77	66	6.73	91.6	1.185	N. 52° E.	1.0
750	926.1	5.0	0.80	67	6.02	89.5	1.158	N. 32° E.	1.3
1,000	898.1	3.8	0.48	66	5.50	87.2	1.128	N. 12° E.	1.0
1,250	871.0	2.8	0.40	65	5.06	84.9	1.098	N. 42° W.	1.1
1,500	844.6	1.8	0.40	63	4.61	82.6	1.068	N. 66° W.	1.8
2,000	793.8	−0.3	0.42	61	3.77	78.3	1.012	N. 75° W.	3.7
2,500	745.6	−2.6	0.46	60	3.07	74.2	0.949	N. 73° W.	6.0
3,000	700.2	−5.2	0.52	62	2.60	70.4	0.910	N. 80° W.	8.9
3,500	657.3	−8.2	0.60	64	2.13	66.8	0.864	N. 85° W.	10.8
4,000	616.4	−11.6	0.68	68	1.74	63.4	0.820	N. 88° W.	13.7
4,500	577.4	−14.7	0.62	67	1.30	60.2	0 778	N. 85° W.	16.1
5,000	540.4	−18.0	0.66	65	0.95	57.1	0.738	N. 82° W.	16.6

May.

0	1,012.3	18.4	.....	68	14.45	93.1	1.204	.....	.....
396	966.4	16.4	.....	64	12.03	89.6	1.158	S. 6° E.	1.6
500	954.6	15.8	0.58	63	11.41	88.7	1.146	S. 5° E.	1.9
750	926.9	14.1	0.68	62	10.19	86.6	1.120	S. 7° E.	2.2
1,000	899.6	12.6	0.60	62	9.24	84.5	1.093	S. 12° W.	2.6
1,250	873.2	11.2	0.56	62	8.35	82.5	1.066	S. 17° W.	2.6
1,500	847.4	9.7	0.60	62	7.46	80.5	1.041	S. 32° W.	3.4
2,000	797.7	7.0	0.54	59	5.76	76.5	0.990	S. 51° W.	4.2
2,500	750.6	4.1	0.58	57	4.56	72.8	0.942	S. 58° W.	4.6
3,000	706.0	0.9	0.64	58	3.68	69.3	0.896	S. 72° W.	6.4
3,500	663.5	−2.0	0.58	58	2.98	65.8	0.851	S. 81° W.	6.4
4,000	623.2	−5.0	0.60	60	2.44	62.6	0.809	N. 85° W.	6.1
4,500	584.8	−8.1	0.62	63	2.04	59.4	0.768	S. 50° W.	8.1
5,000	549.0	−11.5	0.68	68	1.54	56.5	0.730	S. 65° W.	18.3

June.

0	1,012.4	23.6	.....	71	20.56	91.2	1.180	.....	.....
396	967.4	21.2	.....	68	17.20	88.0	1.138	S. 19° W.	1.2
500	955.8	20.5	0.67	67	16.13	87.2	1.127	S. 15° W.	1.4
750	928.5	18.8	0.68	65	14.13	85.2	1.102	S. 27° W.	2.3
1,000	901.8	17.5	0.52	64	12.83	83.2	1.075	S. 46° W.	3.1
1,250	875.8	16.2	0.52	63	11.54	81.2	1.050	S. 59° W.	3.6
1,500	850.4	14.9	0.52	61	10.24	79.2	1.024	S. 60° W.	4.7
2,000	801.5	11.9	0.60	58	8.11	75.5	0.976	S. 72° W.	6.2
2,500	754.9	8.7	0.64	57	6.62	72.0	0.930	S. 83° W.	7.4
3,000	710.6	5.6	0.62	56	5.44	68.5	0.886	S. 89° W.	9.2
3,500	668.5	2.1	0.70	56	4.46	65.3	0.844	N. 89° W.	10.6
4,000	628.5	−1.2	0.66	56	3.67	62.2	0.804	N. 78° W.	10.8
4,500	590.4	−4.2	0.60	52	2.71	59.1	0.764	N. 67° W.	14.2
5,000	554.5	−8.0	0.76	54	1.99	56.3	0.728	N. 51° W.	19.8

TABLE 4b.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Drexel, Nebr.*—Con.

July.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,012.8	27.8	.....	66	23.48	89.9	1.162	.....	.....
396	968.4	25.6	.....	62	20.01	86.7	1.121	S. 2° W.	2.3
500	957.0	25.0	0.58	61	19.09	85.9	1.110	S. 4° W.	3.1
750	930.2	23.6	0.56	59	17.10	83.9	1.085	S. 18° W.	4.2
1,000	903.9	22.2	0.56	58	15.50	82.0	1.060	S. 25° W.	4.5
1,250	878.3	20.7	0.60	57	14.01	80.1	1.035	S. 36° W.	4.8
1,500	853.2	19.1	0.64	57	12.52	78.3	1.012	S. 40° W.	4.6
2,000	805.2	15.8	0.66	55	9.86	74.8	0.967	S. 53° W.	5.3
2,500	759.2	12.4	0.68	54	7.91	71.4	0.923	S. 69° W.	6.0
3,000	715.4	8.9	0.70	53	6.27	68.1	0.881	S. 67° W.	6.7
3,500	673.6	5.3	0.72	54	5.01	65.0	0.841	S. 68° W.	7.2
4,000	634.2	2.0	0.66	53	3.95	62.0	0.802	S. 68° W.	7.0
4,500	596.6	−1.2	0.64	50	3.08	59.0	0.763	S. 50° W.	7.2
5,000	560.8	−3.2	0.40	43	2.36	55.9	0.723	S. 85° W.	6.3

August.

0	1,013.7	24.3	.....	74	21.62	91.1	1.178	.....	.....
396	968.8	22.9	.....	66	18.12	87.6	1.132	S. 14° E.	1.8
500	957.2	22.5	0.38	63	17.20	86.7	1.121	S. 8° E.	2.4
750	930.1	21.4	0.44	59	15.18	84.5	1.093	S. 3° W.	3.5
1,000	903.6	20.2	0.48	57	13.65	82.6	1.067	S. 19° W.	3.8
1,250	877.9	18.9	0.52	56	12.37	80.6	1.042	S. 31° W.	4.2
1,500	852.7	17.4	0.60	55	11.17	78.7	1.018	S. 44° W.	4.4
2,000	804.1	14.1	0.66	56	9.29	75.1	0.972	S. 61° W.	5.9
2,500	757.9	10.7	0.68	57	7.62	71.7	0.927	S. 69° W.	7.3
3,000	713.9	7.2	0.70	58	6.13	68.4	0.885	S. 75° W.	9.0
3,500	672.0	3.8	0.68	57	4.75	65.2	0.843	S. 74° W.	9.9
4,000	632.1	0.5	0.66	51	3.36	62.1	0.803	S. 73° W.	9.9
4,500	595.1	−2.9	0.68	47	2.34	59.3	0.766	N. 84° W.	9.2
5,000	559.1	−6.1	0.64	46	2.05	56.4	0.729	S. 84° W.	10.9

September.

0	1,015.3	19.8	.....	71	15.87	92.9	1.201	.....	.....
396	969.6	18.3	.....	64	13.69	89.2	1.153	S. 22° W.	1.7
500	957.9	18.0	0.29	62	13.12	88.2	1.141	S. 21° W.	2.2
750	930.3	16.8	0.48	59	11.74	86.1	1.113	S. 33° W.	3.5
1,000	903.3	15.6	0.48	57	10.63	84.0	1.086	S. 40° W.	3.8
1,250	877.1	14.5	0.44	55	9.48	81.8	1.058	S. 56° W.	3.9
1,500	851.6	13.3	0.48	53	8.49	79.8	1.032	S. 55° W.	4.7
2,000	802.4	10.5	0.56	52	6.82	76.0	0.983	S. 74° W.	5.5
2,500	755.5	7.4	0.62	52	5.49	72.4	0.936	S. 84° W.	7.5
3,000	710.8	4.4	0.60	51	4.46	68.9	0.890	S. 88° W.	9.2
3,500	668.5	1.4	0.60	49	3.55	65.5	0.847	N. 84° W.	10.7
4,000	628.3	−1.5	0.58	49	2.97	62.2	0.805	N. 71° W.	13.0
4,500	590.3	−4.5	0.60	52	2.43	59.1	0.765	N. 68° W.	14.3
5,000	554.8	−7.4	0.58	53	1.93	56.2	0.727	N. 64° W.	16.2

October.

0	1,016.5	12.8	.....	65	9.43	95.5	1.235	.....	.....
396	969.5	11.1	.....	62	8.54	91.6	1.185	S. 28° W.	1.4
500	957.5	10.7	0.38	61	8.25	90.6	1.172	S. 29° W.	1.8
750	929.2	9.7	0.40	59	7.51	88.3	1.142	S. 41° W.	3.3
1,000	901.5	9.0	0.28	57	6.98	85.9	1.111	S. 54° W.	3.7
1,250	874.9	8.4	0.24	54	6.37	83.4	1.079	S. 58° W.	4.5
1,500	848.8	7.6	0.32	53	5.86	81.3	1.051	S. 69° W.	5.5
2,000	798.7	5.3	0.46	53	5.00	77.1	0.997	S. 76° W.	7.6
2,500	751.3	2.6	0.54	53	4.17	73.3	0.948	S. 77° W.	9.5
3,000	706.3	−0.1	0.54	51	3.38	69.6	0.900	S. 81° W.	10.8
3,500	663.7	−2.8	0.54	50	2.77	66.1	0.854	S. 87° W.	11.7
4,000	623.1	−5.5	0.54	48	2.30	62.7	0.810	S. 87° W.	12.0
4,500	584.6	−7.5	0.40	45	1.93	59.2	0.766	N. 71° W.	15.4
5,000	.....	.....	.....	.....	.....	.....	.....	N. 55° W.	13.9

November.

0	1,019.3	4.5	.....	79	6.69	98.7	1.276	.....	.....
396	970.9	3.7	.....	71	5.81	94.3	1.220	S. 89° W.	1.3
500	958.6	3.6	0.10	68	5.58	93.2	1.205	S. 88° W.	2.0
750	929.5	3.2	0.16	64	5.07	90.5	1.170	W.	3.8
1,000	901.2	3.0	0.08	59	4.59	87.8	1.135	W.	4.8
1,250	873.9	2.7	0.12	56	4.28	85.2	1.102	N. 76° W.	5.7
1,500	847.3	2.3	0.16	54	3.96	82.8	1.070	N. 83° W.	6.6
2,000	795.5	0.6	0.34	51	3.28	78.2	1.011	N. 79° W.	7.3
2,500	747.4	−1.8	0.48	51	2.78	74.1	0.959	N. 77° W.	8.6
3,000	700.7	−4.6	0.56	52	2.39	70.2	0.908	N. 77° W.	10.0
3,500	657.5	−7.3	0.54	53	2.00	66.6	0.861	N. 76° W.	11.0
4,000	616.7	−10.3	0.60	53	1.60	63.2	0.817	N. 83° W.	13.0
4,500	577.6	−13.0	0.54	46	1.13	59.8	0.773	S. 89° W.	14.1
5,000	542.1	−15.6	0.52	38	0.69	56.7	0.733	N. 86° W.	16.1

TABLE 4b.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Drexel, Nebr.*—Con.

December.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,019.5	−5.0	.....	90	4.35	102.3	1.323	.....	.....
396	969.4	−4.5	.....	80	3.76	97.1	1.256	N. 79° W.	0.9
500	956.7	−4.4	−0.10	77	3.61	95.8	1.239	N. 82° W.	1.6
750	926.9	−3.9	−0.20	71	3.37	92.7	1.198	N. 73° W.	3.3
1,000	898.0	−3.0	−0.36	65	3.19	89.5	1.157	N. 72° W.	4.7
1,250	870.1	−2.5	−0.20	60	2.93	86.6	1.119	N. 74° W.	5.1
1,500	843.1	−2.7	0.08	58	2.71	83.9	1.085	N. 77° W.	6.7
2,000	791.6	−4.2	0.30	55	2.26	79.3	1.025	N. 78° W.	8.7
2,500	742.8	−6.4	0.44	55	1.90	75.0	0.970	N. 79° W.	11.1
3,000	695.7	−8.9	0.50	56	1.59	70.9	0.917	N. 80° W.	13.1
3,500	652.1	−11.4	0.50	57	1.30	67.1	0.868	N. 86° W.	15.2
4,000	611.1	−14.3	0.58	57	0.98	63.6	0.822	N. 83° W.	17.2
4,500	572.8	−17.1	0.56	59	0.63	60.3	0.780	N. 70° W.	18.6
5,000	536.7	−19.7	0.52	59	0.37	57.1	0.738	N. 73° W.	17.6

Spring.

0	1,014.0	12.0	.....	68	9.74	95.5	1.235	.....	.....
396	966.9	9.5	.....	65	8.16	91.9	1.189	S. 13° E.	0.6
500	954.8	8.8	0.67	64	7.75	91.0	1.177	S. 8° E.	0.7
750	926.3	7.3	0.60	63	6.93	88.8	1.148	S. 34° W.	0.8
1,000	898.4	6.2	0.44	62	6.28	86.5	1.118	S. 57° W.	1.4
1,250	871.5	5.3	0.36	60	5.72	84.2	1.088	S. 69° W.	2.0
1,500	845.3	4.3	0.40	58	5.15	81.9	1.059	S. 72° W.	3.0
2,000	794.8	2.0	0.46	56	4.12	77.7	1.005	S. 81° W.	4.7
2,500	727.0	−0.6	0.52	55	3.34	73.8	0.954	S. 84° W.	6.2
3,000	701.9	−3.5	0.58	57	2.77	70.1	0.906	S. 86° W.	9.0
3,500	659.1	−6.4	0.58	58	2.27	66.5	0.860	N. 88° W.	10.7
4,000	618.5	−9.4	0.60	60	1.89	63.2	0.816	N. 83° W.	13.3
4,500	579.7	−12.9	0.70	68	1.58	60.0	0.775	S. 88° W.	13.1
5,000	543.1	−16.3	0.68	67	1.09	57.0	0.736	S. 89° W.	16.1

Summer.

0	1,013.0	25.2	.....	70	21.89	90.8	1.174	.....	.....
396	968.2	23.2	.....	65	18.44	87.4	1.130	S.	1.7
500	956.7	22.6	0.58	63	17.47	86.6	1.120	S. 2° W.	2.3
750	929.6	21.2	0.56	60	15.47	84.6	1.094	S. 15° W.	3.3
1,000	903.1	19.9	0.52	59	13.99	82.6	1.068	S. 29° W.	3.8
1,250	877.3	18.5	0.56	58	12.64	80.6	1.043	S. 41° W.	4.1
1,500	852.1	17.0	0.60	57	11.31	78.8	1.018	S. 51° W.	4.5
2,000	803.6	13.8	0.64	56	9.09	75.2	0.972	S. 63° W.	5.7
2,500	757.3	10.5	0.66	56	7.39	71.7	0.927	S. 74° W.	6.9
3,000	713.3	7.1	0.68	56	5.95	68.4	0.884	S. 78° W.	8.3
3,500	671.4	3.6	0.70	56	4.74	65.2	0.843	S. 79° W.	9.1
4,000	631.6	0.3	0.66	54	3.66	62.1	0.803	S. 83° W.	8.8
4,500	594.0	−2.9	0.64	50	2.71	59.1	0.765	N. 86° W.	9.4
5,000	558.1	−5.9	0.60	48	2.13	56.2	0.727	N. 71° W.	12.1

Autumn.

0	1,017.0	12.4	.....	72	10.66	95.6	1.236	.....	.....
396	970.0	11.0	.....	66	9.35	91.7	1.185	S. 44° W.	1.2
500	958.0	10.7	0.29	64	8.99	90.7	1.172	S. 45° W.	1.8
750	929.7	9.8	0.36	61	8.11	88.3	1.142	S. 56° W.	3.1
1,000	902.0	9.1	0.28	58	7.40	85.9	1.111	S. 64° W.	3.8
1,250	875.3	8.4	0.28	55	6.71	83.6	1.081	S. 72° W.	4.5
1,500	849.2	7.6	0.32	53	6.10	81.3	1.051	S. 79° W.	5.4
2,000	798.8	5.3	0.46	52	5.03	77.1	0.997	S. 85° W.	6.6
2,500	751.3	2.6	0.54	52	4.14	73.3	0.948	S. 88° W.	8.4
3,000	705.8	−0.2	0.56	51	3.40	69.6	0.899	N. 89° W.	9.9
3,500	663.1	−3.0	0.56	50	2.76	66.1	0.854	N. 85° W.	11.0
4,000	622.6	−5.9	0.58	49	2.28	62.7	0.811	N. 83° W.	12.5
4,500	584.1	−8.5	0.52	47	1.82	59.4	0.768	N. 78° W.	14.2
5,000	548.6	−11.3	0.56	43	1.35	56.4	0.730	N. 66° W.	16.0

Winter.

0	1,020.8	−4.9	.....	90	4.19	102.4	1.324	.....	.....
396	970.6	−5.3	.....	80	3.59	97.5	1.261	N. 70° W.	1.3
500	957.9	−5.4	0.10	77	3.42	96.3	1.245	N. 72° W.	2.1
750	927.9	−5.3	−0.04	72	3.11	93.3	1.206	N. 68° W.	4.1
1,000	898.8	−4.4	−0.36	66	2.94	90.0	1.164	N. 68° W.	5.5
1,250	870.8	−3.8	−0.24	61	2.76	87.0	1.126	N. 68° W.	6.4
1,500	843.7	−3.9	0.04	58	2.57	84.4	1.091	N. 69° W.	7.9
2,000	791.9	−5.0	0.22	55	2.19	79.4	1.027	N. 71° W.	10.1
2,500	743.0	−7.1	0.42	54	1.84	75.2	0.973	N. 75° W.	12.5
3,000	696.6	−9.5	0.48	55	1.55	71.2	0.920	N. 76° W.	14.4
3,500	653.0	−12.0	0.50	55	1.23	67.4	0.871	N. 78° W.	15.8
4,000	611.9	−14.8	0.56	54	0.94	63.8	0.825	N. 81° W.	17.3
4,500	573.7	−17.9	0.62	56	0.74	60.6	0.783	N. 76° W.	18.7
5,000	537.3	−21.1	0.64	56	0.54	57.4	0.742	N. 76° W.	18.2

TABLE 4b.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Drexel, Nebr.*—Con.

Annual.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,016.2	11.2	.....	75	11.62	95.9	1.240	.....	.....
396	968.9	9.6	.....	69	9.88	92.0	1.190	S. 37° W.	0.9
500	956.8	9.2	0.38	67	9.40	91.0	1.177	S. 43° W.	1.2
750	928.3	8.3	0.36	64	8.40	88.6	1.146	S. 63° W.	2.1
1,000	900.5	7.6	0.24	61	7.65	86.2	1.114	S. 72° W.	3.0
1,250	873.7	7.0	0.24	58	6.95	83.8	1.084	S. 80° W.	3.8
1,500	847.5	6.2	0.32	56	6.27	81.6	1.054	S. 85° W.	4.8
2,000	797.2	4.0	0.44	54	5.09	77.4	1.000	S. 89° W.	6.6
2,500	749.6	1.3	0.54	53	4.16	73.5	0.950	N. 88° W.	8.5
3,000	704.3	−1.6	0.58	53	3.40	69.8	0.902	N. 87° W.	10.4
3,500	661.5	−4.5	0.58	53	2.74	66.3	0.857	N. 86° W.	11.6
4,000	621.0	−7.5	0.60	52	2.18	62.9	0.814	N. 85° W.	12.7
4,500	582.7	−10.6	0.62	53	1.70	59.8	0.773	N. 82° W.	13.3
5,000	546.6	−13.7	0.62	51	1.25	56.7	0.734	N. 76° W.	14.4

TABLE 4c.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Ellendale, N. Dak.*

January.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,021.7	−11.1	.....	86	2.70	105.0	1.358	.....	.....
444	964.3	−11.0	.....	79	2.41	99.1	1.281	N. 48° W.	3.6
500	957.2	−11.0	0.00	78	2.38	98.3	1.272	N. 48° W.	4.3
750	926.5	−10.7	−0.12	72	2.19	95.1	1.229	N. 53° W.	6.6
1,000	896.8	−9.1	−0.64	65	2.16	91.5	1.183	N. 55° W.	8.1
1,250	868.3	−8.0	−0.44	60	2.14	88.2	1.141	N. 56° W.	9.4
1,500	840.9	−7.9	−0.04	58	2.04	85.4	1.104	N. 53° W.	9.9
2,000	788.7	−9.5	0.32	58	1.78	80.6	1.042	N. 57° W.	12.6
2,500	739.6	−11.9	0.48	58	1.40	76.3	0.986	N. 57° W.	14.7
3,000	693.1	−14.8	0.58	59	1.03	72.3	0.935	N. 58° W.	16.6
3,500	649.6	−17.6	0.56	59	0.76	68.5	0.886	N. 61° W.	16.8
4,000	608.2	−20.0	0.48	59	0.54	64.7	0.837	N. 58° W.	16.9
4,500	568.4	−22.4	0.48	58	0.48	61.1	0.790	N. 49° W.	19.1
5,000	530.2	−24.8	0.48	58	0.44	57.5	0.744	N. 76° W.	17.3

February.

0	1,020.6	−9.8	.....	84	2.68	104.4	1.350	.....	.....
444	963.5	−10.0	.....	79	2.48	98.6	1.275	N. 30° W.	3.3
500	956.5	−10.1	0.18	78	2.46	97.9	1.266	N. 33° W.	3.6
750	925.9	−10.1	0.00	76	2.34	94.8	1.226	N. 40° W.	4.6
1,000	896.2	−10.0	−0.04	73	2.25	91.7	1.186	N. 38° W.	5.2
1,250	867.7	−9.5	−0.20	69	2.15	88.6	1.146	N. 42° W.	6.2
1,500	840.1	−9.4	−0.04	65	2.03	85.7	1.108	N. 51° W.	7.6
2,000	787.4	−10.5	0.22	63	1.78	80.8	1.044	N. 57° W.	9.7
2,500	737.6	−12.3	0.36	60	1.53	76.2	0.985	N. 62° W.	12.9
3,000	690.7	−14.4	0.42	56	1.25	71.9	0.930	N. 63° W.	14.4
3,500	646.8	−16.9	0.50	53	0.96	68.0	0.879	N. 64° W.	13.8
4,000	605.0	−19.2	0.46	52	0.83	64.2	0.830	N. 62° W.	14.8
4,500	566.0	−21.9	0.54	45	0.61	60.7	0.785	N. 70° W.	15.3
5,000	529.3	−24.9	0.60	38	0.37	57.5	0.743	S. 67° W.	18.5

March.

0	1,017.3	−1.8	.....	89	4.97	100.9	1.304	.....	.....
444	962.0	−2.4	.....	75	4.11	95.6	1.236	N. 63° W.	1.5
500	955.3	−2.4	0.00	73	4.01	95.0	1.228	N. 76° W.	1.4
750	925.6	−2.6	0.08	66	3.56	92.1	1.191	S. 80° W.	2.4
1,000	896.7	−2.4	−0.08	60	3.32	89.2	1.153	S. 79° W.	3.0
1,250	868.9	−2.9	0.20	55	3.11	86.6	1.119	S. 88° W.	3.8
1,500	841.9	−3.4	0.20	52	2.89	84.0	1.086	N. 88° W.	5.4
2,000	790.5	−5.0	0.32	49	2.36	79.4	1.026	N. 84° W.	7.4
2,500	741.8	−7.3	0.46	49	1.96	75.1	0.972	N. 79° W.	10.4
3,000	695.6	−9.8	0.50	47	1.52	71.2	0.920	N. 78° W.	10.8
3,500	651.7	−12.3	0.50	43	1.15	67.3	0.870	N. 86° W.	12.1
4,000	609.5	−14.9	0.52	43	0.89	63.6	0.822	N. 86° W.	15.2
4,500	570.5	−18.1	0.64	44	0.60	60.3	0.779	N. 78° W.	16.4
5,000	533.1	−21.5	0.68	44	0.38	57.1	0.738	S. 89° W.	20.1

April.

0	1,015.6	8.3	.....	63	6.44	97.0	1.255	.....	.....
444	962.1	4.7	.....	63	5.42	93.1	1.204	N. 13° W.	1.9
500	955.4	4.2	0.89	63	5.29	92.6	1.198	N. 14° W.	1.8
750	926.5	2.3	0.76	63	4.73	90.5	1.170	N. 16° W.	1.0
1,000	898.0	0.7	0.64	63	4.26	88.2	1.141	N. 15° W.	1.0
1,250	870.4	−0.5	0.48	62	3.83	85.9	1.111	N. 31° W.	1.6
1,500	843.6	−1.5	0.40	60	3.42	83.6	1.081	N. 34° W.	2.2
2,000	792.1	−3.9	0.48	58	2.76	79.2	1.024	N. 53° W.	1.9
2,500	743.6	−6.3	0.48	56	2.15	75.0	0.970	N. 70° W.	2.1
3,000	697.4	−8.9	0.52	58	1.80	71.1	0.919	N. 51° W.	4.0
3,500	653.8	−11.6	0.54	61	1.54	67.2	0.869	N. 63° W.	4.5
4,000	612.4	−14.6	0.60	63	1.24	63.8	0.825	N. 43° W.	7.8
4,500	573.5	−17.2	0.52	67	0.92	60.4	0.781	N. 61° W.	9.8

TABLE 4c.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Ellendale, N. Dak.*—Continued.

May.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*° C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,012.9	17.7	.....	60	11.76	93.5	1.208	.....	.....
444	961.3	14.0	.....	60	9.54	89.9	1.162	S. 51° E.	0.8
500	954.8	13.5	0.89	60	9.29	89.4	1.157	S. 39° E.	0.9
750	926.8	11.8	0.68	59	8.19	87.3	1.129	S. 27° E.	1.1
1,000	899.3	10.2	0.64	59	7.44	85.3	1.103	S. 11° E.	1.6
1,250	872.6	8.7	0.60	60	6.90	83.2	1.076	S. 6° W.	2.1
1,500	846.6	7.2	0.60	60	6.24	81.2	1.050	S. 12° W.	2.6
2,000	796.6	4.0	0.64	60	4.98	77.3	1.000	S. 25° W.	3.6
2,500	749.1	0.6	0.68	59	3.77	73.6	0.952	S. 36° W.	5.2
3,000	703.8	−2.6	0.64	61	3.07	70.0	0.905	S. 50° W.	7.3
3,500	660.9	−5.1	0.50	58	2.37	66.3	0.857	S. 51° W.	6.8
4,000	620.1	−7.7	0.52	55	1.85	62.9	0.813	N. 78° W.	7.3
4,500	581.8	−10.3	0.52	51	1.41	59.6	0.771	N. 59° E.	12.2

June.

0	1,012.9	22.5	.....	73	20.42	91.7	1.185	.....	.....
444	962.3	19.3	.....	73	16.64	88.1	1.140	N. 73° E.	0.5
500	956.1	18.9	0.71	73	16.18	87.7	1.134	N. 81° E.	0.5
750	928.7	17.0	0.76	73	14.40	85.8	1.109	S. 70° E.	0.7
1,000	901.7	15.6	0.56	72	13.00	83.7	1.082	S. 31° E.	0.8
1,250	875.5	14.4	0.48	70	11.62	81.7	1.056	S. 54° W.	1.1
1,500	849.9	13.1	0.52	69	10.45	79.7	1.030	S. 54° W.	1.2
2,000	800.6	10.1	0.60	66	8.52	75.9	0.981	S. 66° W.	2.6
2,500	753.4	7.2	0.58	63	6.92	72.2	0.934	S. 82° W.	4.6
3,000	709.0	4.4	0.56	59	5.41	68.7	0.888	N. 89° W.	6.4
3,500	666.8	1.5	0.58	56	4.40	65.3	0.844	N. 87° W.	9.1
4,000	626.4	−1.4	0.58	53	3.60	62.0	0.802	N. 75° W.	10.5
4,500	588.2	−5.0	0.72	66	3.44	58.8	0.760	N. 70° W.	15.0
5,000	552.0	−7.8	0.56	66	3.33	56.0	0.724	N. 67° W.	21.5

July.

0	1,013.5	24.0	.....	80	21.30	91.2	1.179	.....	.....
444	963.1	21.1	.....	71	17.39	87.6	1.133	S. 21° E.	0.2
500	956.9	20.7	0.71	70	16.79	87.2	1.128	S. 20° E.	0.3
750	929.6	19.3	0.56	65	14.47	85.2	1.101	S. 9° W.	0.9
1,000	902.9	18.1	0.48	62	12.96	83.1	1.075	S. 47° W.	1.4
1,250	876.9	17.0	0.44	59	11.48	81.1	1.048	S. 66° W.	2.0
1,500	851.4	16.0	0.40	54	9.84	79.0	1.022	S. 74° W.	2.8
2,000	802.8	13.3	0.54	51	7.87	75.3	0.973	S. 81° W.	4.8
2,500	756.5	10.2	0.62	48	6.28	71.8	0.928	N. 84° W.	6.8
3,000	712.3	6.9	0.66	47	4.93	68.4	0.884	N. 88° W.	8.8
3,500	670.5	3.2	0.74	48	3.93	65.2	0.844	N. 83° W.	11.4
4,000	629.9	0.3	0.58	44	2.76	62.0	0.802	N. 81° W.	11.7
4,500	592.5	−1.9	0.44	43	2.46	58.8	0.760	N. 76° W.	14.6
5,000	556.6	−4.5	0.52	41	2.24	55.8	0.721	N. 45° W.	16.1

August.

0	1,013.1	22.8	.....	69	17.77	91.7	1.185	.....	.....
444	962.6	20.8	.....	63	15.01	87.8	1.135	S. 39° W.	1.4
500	956.5	20.5	0.54	62	14.69	87.3	1.129	S. 37° W.	1.9
750	929.1	19.5	0.40	59	13.31	85.1	1.100	S. 33° W.	2.7
1,000	902.3	18.2	0.52	58	12.18	83.1	1.074	S. 40° W.	3.1
1,250	876.4	16.6	0.64	58	11.10	81.2	1.049	S. 49° W.	3.4
1,500	851.1	15.0	0.64	58	10.02	79.3	1.025	S. 54° W.	3.6
2,000	802.1	11.7	0.66	56	7.68	75.6	0.978	S. 70° W.	4.0
2,500	755.4	8.7	0.60	51	5.82	72.0	0.932	S. 83° W.	5.6
3,000	710.9	5.8	0.58	48	4.48	68.5	0.886	S. 88° W.	6.7
3,500	668.8	3.0	0.56	43	3.41	65.2	0.842	N. 87° W.	9.5
4,000	628.9	−0.2	0.64	42	2.66	62.0	0.802	N. 86° W.	10.0
4,500	590.8	−3.7	0.70	43	2.01	59.0	0.763	S. 86° W.	9.7
5,000	554.0	−6.8	0.62	39	1.46	56.0	0.724	S. 80° W.	13.3

September.

0	1,014.6	15.2	.....	70	12.15	94.4	1.221	.....	.....
444	962.7	14.5	.....	65	10.72	89.8	1.162	N. 50° W.	0.8
500	956.4	14.4	0.18	64	10.58	89.3	1.154	N. 63° W.	0.9
750	928.5	13.7	0.28	62	9.77	86.9	1.124	N. 75° W.	0.7
1,000	901.2	12.6	0.44	61	8.93	84.7	1.095	S. 82° W.	1.2
1,250	874.8	11.5	0.44	59	7.95	82.6	1.067	S. 75° W.	1.8
1,500	849.0	10.3	0.48	56	7.11	80.5	1.041	S. 86° W.	2.6
2,000	799.3	7.8	0.50	51	5.69	76.5	0.989	S. 78° W.	4.0
2,500	752.0	4.7	0.62	53	4.92	72.8	0.941	S. 87° W.	6.2
3,000	707.4	1.2	0.70	55	4.29	69.4	0.887	S. 88° W.	9.1
3,500	664.7	−1.7	0.58	54	3.75	65.9	0.852	S. 89° W.	9.7
4,000	624.3	−4.9	0.64	55	3.35	62.6	0.809	N. 62° W.	11.2
4,500	586.6	−7.1	0.44	55	3.08	59.3	0.767	W.	18.0

TABLE 4c.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Ellendale, N. Dak.*—Continued.

October.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*° C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,015.6	8.8	.....	72	8.31	96.8	1.252	.....	.....
444	962.4	7.5	.....	68	7.14	92.2	1.192	N. 73° W.	1.5
500	955.8	7.4	0.18	67	7.01	91.6	1.184	N. 79° W.	1.5
750	927.2	6.6	0.32	65	6.47	79.1	1.152	N. 82° W.	2.1
1,000	899.3	6.0	0.24	63	5.96	86.6	1.120	N. 86° W.	2.6
1,250	872.3	5.2	0.32	60	5.37	84.3	1.090	W.	3.4
1,500	846.1	4.5	0.28	56	4.77	82.0	1.060	S. 84° W.	4.1
2,000	795.9	2.1	0.48	53	3.66	77.8	1.006	S. 89° W.	6.0
2,500	748.1	−0.7	0.56	52	2.89	73.9	0.956	N. 83° W.	7.8
3,000	702.7	−3.8	0.62	51	2.20	70.2	0.908	S. 88° W.	9.2
3,500	659.6	−6.9	0.62	51	1.67	66.7	0.863	S. 85° W.	12.2
4,000	619.2	−9.9	0.60	49	1.09	63.4	0.819	S. 76° W.	14.1
4,500	580.8	−13.5	0.72	48	0.51	60.3	0.778	S. 73° W.	15.0
5,000	544.3	−16.7	0.64	44	0.06	57.2	0.740	S. 77° W.	18.9

November.

0	1,020.3	−1.8	.....	90	4.87	101.2	1.308	.....	.....
444	964.7	−3.3	.....	80	4.04	96.2	1.244	N. 52° W.	2.5
500	957.9	−3.4	0.18	79	3.94	95.6	1.236	N. 62° W.	2.7
750	928.0	−3.3	−0.04	73	3.60	92.6	1.197	N. 53° W.	4.0
1,000	899.1	−2.9	−0.16	67	3.33	89.6	1.158	N. 64° W.	4.4
1,250	871.2	−2.7	−0.08	61	3.03	86.7	1.121	N. 67° W.	5.1
1,500	844.2	−3.1	0.16	58	2.77	84.2	1.088	N. 64° W.	6.6
2,000	792.6	−4.7	0.32	55	2.33	79.5	1.028	N. 64° W.	8.3
2,500	743.8	−7.0	0.46	57	2.04	75.2	0.973	N. 63° W.	10.8
3,000	697.8	−9.5	0.50	58	1.72	71.3	0.912	N. 66° W.	12.7
3,500	654.4	−12.4	0.58	60	1.39	67.6	0.874	N. 60° W.	13.9
4,000	613.4	−15.4	0.60	61	1.11	64.1	0.829	N. 57° W.	11.9
4,500	573.9	−17.9	0.50	54	0.83	60.6	0.783	N. 38° W.	13.6

December.

0	1,018.8	−8.2	.....	92	3.50	103.5	1.339	.....	.....
444	962.2	−7.4	.....	83	3.05	97.5	1.260	N. 42° W.	3.2
500	955.3	−7.4	0.00	82	3.02	96.8	1.252	N. 49° W.	3.3
750	925.0	−6.8	−0.24	76	2.86	93.5	1.209	N. 53° W.	4.8
1,000	895.7	−5.9	−0.36	69	2.76	90.3	1.167	N. 51° W.	5.7
1,250	867.6	−5.3	−0.24	64	2.68	87.2	1.128	N. 51° W.	6.6
1,500	840.4	−5.4	0.04	61	2.47	84.5	1.093	N. 55° W.	7.9
2,000	788.2	−6.8	0.28	57	2.00	79.7	1.030	N. 57° W.	8.6
2,500	739.2	−9.2	0.48	57	1.64	75.4	0.975	N. 59° W.	10.6
3,000	692.8	−12.2	0.60	58	1.27	71.5	0.925	N. 66° W.	12.8
3,500	648.8	−15.1	0.58	57	0.97	67.7	0.876	N. 80° W.	14.8
4,000	607.0	−18.2	0.62	55	0.72	64.2	0.830	N. 79° W.	15.0
4,500	567.7	−21.2	0.60	50	0.50	60.7	0.785	S. 73° W.	16.2
5,000	530.4	−24.5	0.66	48	0.32	57.5	0.743	S. 77° W.	15.3

Spring.

0	1,015.3	8.1	.....	71	7.72	97.0	1.255	.....	.....
444	961.8	5.4	.....	66	6.36	92.8	1.200	N. 20° W.	0.7
500	955.2	5.1	0.54	65	6.20	92.3	1.193	N. 42° W.	0.5
750	926.3	3.8	0.52	62	5.48	90.0	1.163	S. 73° W.	0.7
1,000	898.0	2.8	0.40	60	4.99	87.5	1.132	S. 65° W.	1.0
1,250	870.6	1.7	0.44	58	4.60	85.2	1.102	S. 77° W.	1.5
1,500	844.0	0.7	0.40	56	4.17	82.9	1.072	S. 84° W.	2.3
2,000	793.0	−1.7	0.48	54	3.35	78.6	1.017	S. 80° W.	3.6
2,500	744.8	−4.4	0.54	53	2.61	74.6	0.965	S. 84° W.	5.3
3,000	698.9	−7.2	0.56	54	2.11	70.8	0.915	N. 89° W.	6.8
3,500	655.4	−9.8	0.52	53	1.67	67.0	0.867	S. 87° W.	7.9
4,000	613.9	−12.5	0.54	53	1.31	63.4	0.820	N. 79° W.	10.1
4,500	575.2	−15.3	0.56	53	0.96	60.1	0.777	N. 62° W.	9.3
5,000	537.8	−18.7	0.68	53	0.74	57.0	0.736	N. 67° W.	11.0

Summer.

0	1,013.2	23.1	.....	74	19.83	91.5	1.181	.....	.....
444	962.7	20.4	.....	69	16.35	87.8	1.136	S. 14° W.	0.4
500	956.5	20.0	0.71	68	15.89	87.4	1.130	S. 14° W.	0.6
750	929.1	18.6	0.56	65	14.06	85.4	1.104	S. 16° W.	1.1
1,000	902.3	17.3	0.52	63	12.71	83.3	1.077	S. 33° W.	1.6
1,250	876.3	16.0	0.52	61	11.40	81.3	1.051	S. 55° W.	2.2
1,500	850.8	14.7	0.52	59	10.10	79.3	1.026	S. 61° W.	2.5
2,000	801.8	11.7	0.60	56	8.02	75.6	0.978	S. 73° W.	3.8
2,500	755.1	8.7	0.60	52	6.34	72.0	0.931	S. 88° W.	5.7
3,000	710.7	5.7	0.60	49	4.94	68.5	0.886	W.	7.2
3,500	668.7	2.6	0.62	47	3.91	65.2	0.843	N. 85° W.	10.0
4,000	628.4	−0.4	0.60	44	3.00	62.0	0.802	N. 81° W.	10.5
4,500	590.5	−3.5	0.62	48	2.63	58.9	0.762	N. 83° W.	11.6
5,000	554.2	−6.3	0.56	46	2.34	55.9	0.723	N. 85° W.	14.4

TABLE 4c.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Ellendale, N. Dak.*—Continued.

Autumn.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*° C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,016.8	7.4	.....	77	8.44	97.4	1.259	.....	.....
444	963.3	6.2	.....	71	7.30	92.7	1.198	N. 58° W.	1.7
500	956.7	6.1	0.18	70	7.18	92.1	1.191	N. 67° W.	1.7
750	927.9	5.6	0.20	67	6.62	89.5	1.157	N. 69° W.	2.1
1,000	899.9	5.2	0.16	64	6.08	86.9	1.124	N. 76° W.	2.7
1,250	872.8	4.6	0.24	60	5.46	84.5	1.093	N. 81° W.	3.3
1,500	846.5	3.8	0.32	57	4.89	82.2	1.063	N. 81° W.	4.3
2,000	796.0	1.6	0.44	53	3.90	77.9	1.008	N. 82° W.	5.9
2,500	748.0	−1.1	0.54	54	3.29	74.0	0.957	N. 77° W.	8.0
3,000	702.7	−4.1	0.60	55	2.74	70.3	0.909	N. 81° W.	10.1
3,500	659.6	−7.1	0.60	55	2.27	66.7	0.863	N. 81° W.	11.6
4,000	619.0	−10.2	0.62	55	1.85	63.4	0.820	N. 82° W.	11.8
4,500	580.5	−13.0	0.56	52	1.47	60.1	0.777	N. 76° W.	13.8
5,000	544.0	−16.2	0.64	48	1.02	57.0	0.738	S. 78° W.	16.1

Winter.

0	1,020.4	−9.7	.....	87	2.96	104.3	1.348	.....	.....
444	963.3	−9.5	.....	80	2.65	98.4	1.272	N. 40° W.	3.4
500	956.3	−9.5	0.00	79	2.62	97.7	1.263	N. 44° W.	3.8
750	925.8	−9.2	−0.12	74	2.46	94.4	1.221	N. 49° W.	5.3
1,000	896.2	−8.3	−0.36	68	2.39	91.1	1.178	N. 50° W.	6.3
1,250	867.8	−7.6	−0.28	63	2.32	88.0	1.138	N. 51° W.	7.3
1,500	840.4	−7.6	0.00	60	2.18	85.2	1.102	N. 33° W.	8.5
2,000	788.0	−9.0	0.28	58	1.85	80.3	1.039	N. 57° W.	10.2
2,500	738.7	−11.2	0.44	57	1.52	76.0	0.982	N. 59° W.	12.6
3,000	692.1	−13.9	0.54	56	1.18	71.9	0.930	N. 62° W.	14.6
3,500	648.3	−16.6	0.54	55	0.89	68.1	0.880	N. 55° W.	17.1
4,000	606.6	−19.2	0.52	54	0.69	64.4	0.832	N. 66° W.	15.4
4,500	567.2	−21.9	0.54	50	0.52	60.8	0.787	N. 80° W.	15.1
5,000	529.8	−24.8	0.58	47	0.37	57.5	0.743	S. 81° W.	16.1

Annual.

0	1,016.4	7.2	.....	77	9.74	97.4	1.259	.....	.....
444	962.8	5.6	.....	72	8.16	92.8	1.200	N. 48° W.	1.3
500	956.2	5.4	0.36	71	7.97	92.2	1.193	N. 57° W.	1.3
750	927.3	4.7	0.28	68	7.15	89.7	1.160	N. 68° W.	1.8
1,000	899.1	4.2	0.20	65	6.54	87.1	1.127	N. 74° W.	2.3
1,250	871.9	3.6	0.24	62	5.94	84.7	1.095	N. 75° W.	3.1
1,500	845.5	2.8	0.32	60	5.34	82.4	1.065	N. 76° W.	3.9
2,000	794.8	0.6	0.44	58	4.29	78.1	1.010	N. 79° W.	5.4
2,500	746.7	−2.1	0.54	57	3.45	74.1	0.959	N. 76° W.	7.5
3,000	701.1	−5.0	0.58	57	2.75	70.4	0.910	N. 78° W.	9.3
3,500	658.0	−7.8	0.56	56	2.19	66.8	0.863	N. 75° W.	11.2
4,000	617.0	−10.6	0.56	55	1.72	63.3	0.818	N. 76° W.	12.0
4,500	578.4	−13.4	0.56	54	1.40	60.0	0.775	N. 77° W.	12.5
5,000	541.5	−16.4	0.60	52	1.15	56.8	0.735	S. 89° W.	14.1

TABLE 4d.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Groesbeck, Tex.*

January.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*° C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,023.3	8.0	.....	84	9.70	97.8	1.264	.....	.....
141	1,005.9	7.1	.....	81	8.52	96.4	1.247	N. 13° W.	2.1
250	992.8	6.8	0.28	78	8.06	95.3	1.232	N. 13° W.	2.2
500	962.8	5.7	0.44	75	7.45	92.8	1.200	N. 36° W.	1.9
750	933.9	5.7	0.00	71	6.99	90.0	1.164	N. 57° W.	2.3
1,000	905.8	5.6	0.04	65	6.33	87.4	1.130	N. 65° W.	2.5
1,250	878.7	5.1	0.20	60	5.60	84.9	1.098	N. 68° W.	3.5
1,500	852.2	4.5	0.24	55	4.88	82.6	1.068	N. 58° W.	4.2
2,000	801.7	3.3	0.24	48	3.97	78.0	1.009	N. 65° W.	5.0
2,500	753.8	1.5	0.36	47	3.46	73.8	0.955	N. 77° W.	5.8
3,000	708.4	−0.6	0.42	43	3.00	70.0	0.905	N. 72° W.	8.2
3,500	665.1	−3.1	0.50	42	2.57	66.3	0.857	N. 76° W.	10.7
4,000	624.0	−5.9	0.56	40	2.23	62.9	0.813	N. 81° W.	11.2
4,500	585.4	−8.5	0.52	38	2.13	59.5	0.770	N. 44° W.	9.2
5,000	548.9	−11.9	0.68	.....	.....	56.6	0.731	W.	13.0

February.

0	1,018.9	10.8	.....	75	9.97	96.4	1.246	.....	.....
141	1,001.8	9.8	.....	73	9.31	95.1	1.230	N. 52° W.	0.9
250	988.9	9.3	0.46	71	8.91	94.0	1.216	N. 56° W.	0.8
500	959.2	7.9	0.56	69	7.93	91.7	1.186	S. 68° W.	1.4
750	930.6	7.2	0.28	65	7.23	89.2	1.154	S. 67° W.	2.6
1,000	902.6	6.8	0.16	60	6.40	86.7	1.121	S. 79° W.	4.1
1,250	875.6	6.2	0.24	55	5.56	84.3	1.090	W.	4.8
1,500	849.3	5.5	0.28	50	4.67	82.0	1.060	N. 81° W.	6.3
2,000	799.1	3.5	0.40	46	3.69	77.7	1.005	N. 77° W.	8.3
2,500	751.5	1.2	0.46	42	2.92	73.7	0.954	N. 87° W.	9.1
3,000	706.4	−1.3	0.50	39	2.37	69.9	0.904	S. 87° W.	12.6
3,500	663.2	−3.3	0.40	33	1.60	66.2	0.856	S. 89° W.	14.5
4,000	623.1	−6.1	0.56	25	1.07	62.9	0.813	N. 34° W.	10.1

TABLE 4d.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Groesbeck, Tex.*—Continued.

March.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*° C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,017.6	14.4	.....	69	11.75	95.0	1.228	.....	.....
141	1,000.7	13.6	.....	67	10.95	93.7	1.211	S. 13° E.	1.4
250	987.9	13.0	0.55	65	10.39	92.7	1.199	S. 16° E.	2.3
500	958.9	11.8	0.48	61	9.04	90.4	1.169	S. 2° E.	4.3
750	930.7	10.7	0.44	57	7.94	88.1	1.139	S. 14° W.	4.5
1,000	903.2	9.7	0.40	53	6.96	85.8	1.110	S. 26° W.	4.8
1,250	876.4	8.9	0.32	49	6.05	83.6	1.080	S. 38° W.	5.2
1,500	850.3	8.1	0.32	46	5.30	81.3	1.051	S. 44° W.	5.7
2,000	800.2	6.1	0.40	37	3.64	77.1	0.997	S. 58° W.	6.5
2,500	752.8	3.6	0.50	35	2.91	73.2	0.947	S. 66° W.	9.6
3,000	707.6	1.5	0.42	31	2.30	69.4	0.897	S. 77° W.	10.0
3,500	664.8	−1.1	0.52	30	1.95	65.8	0.851	S. 85° W.	13.0
4,000	623.7	−3.8	0.54	28	1.77	62.3	0.806	S. 87° W.	14.3
4,500	586.6	−5.4	0.32	28	1.72	59.0	0.763	N. 86° W.	14.9
5,000	550.3	−7.0	0.32	28	1.68	55.7	0.720	N. 67° W.	19.1

April.

0	1,012.8	19.5	.....	65	15.05	92.8	1.199	.....	.....
141	996.3	18.4	.....	65	14.07	91.6	1.185	S. 10° W.	2.9
250	983.8	17.6	0.73	65	13.40	90.7	1.173	S. 9° W.	3.8
500	955.1	15.5	0.84	65	11.83	88.8	1.148	S. 14° W.	5.5
750	927.4	14.2	0.52	64	10.60	86.6	1.120	S. 22° W.	6.0
1,000	900.3	13.4	0.32	59	9.10	84.4	1.091	S. 28° W.	6.2
1,250	874.2	12.6	0.32	53	7.74	82.2	1.063	S. 41° W.	6.5
1,500	848.4	11.8	0.32	48	6.35	80.0	1.035	S. 42° W.	7.0
2,000	799.2	9.8	0.40	43	4.91	76.0	0.982	S. 51° W.	8.2
2,500	752.3	7.3	0.50	41	3.88	72.2	0.933	S. 56° W.	9.5
3,000	708.0	4.4	0.58	39	3.05	68.6	0.888	S. 62° W.	13.8
3,500	666.3	1.6	0.56	48	2.66	65.3	0.844	S. 48° W.	12.8
4,000	626.5	−2.0	0.72	57	2.44	62.2	0.804	S. 68° W.	14.4

May.

0	1,011.7	24.4	.....	73	21.45	90.9	1.176	.....	.....
141	995.5	23.0	.....	74	20.44	89.9	1.162	S. 9° E.	1.8
250	983.3	22.0	0.92	75	19.52	89.1	1.152	S. 4° E.	2.5
500	955.2	19.9	0.84	76	17.54	87.3	1.128	S. 4° W.	3.5
750	927.9	18.6	0.52	74	15.67	85.2	1.102	S. 7° W.	4.4
1,000	901.3	17.2	0.56	72	14.01	83.2	1.076	S. 23° W.	5.3
1,250	875.4	16.2	0.40	68	12.27	81.1	1.049	S. 25° W.	5.7
1,500	850.1	15.0	0.48	65	10.76	79.2	1.024	S. 34° W.	5.7
2,000	801.4	12.5	0.50	57	8.01	75.3	0.974	S. 34° W.	5.5
2,500	755.1	10.0	0.50	51	6.22	71.6	0.925	S. 45° W.	6.2
3,000	711.4	7.5	0.50	46	4.90	68.1	0.881	S. 50° W.	6.5
3,500	669.0	4.6	0.58	44	3.93	64.8	0.838	S. 59° W.	10.3

June.

0	1,014.9	26.9	.....	71	24.00	90.4	1.168	.....	.....
141	998.8	25.4	.....	71	22.82	89.4	1.156	S. 29° E.	2.5
250	986.6	24.3	1.01	71	21.81	88.7	1.146	S. 30° E.	3.0
500	958.6	22.2	0.84	70	19.67	86.8	1.122	S. 19° E.	4.1
750	931.3	20.7	0.60	69	17.92	84.8	1.097	S. 18° E.	4.2
1,000	904.7	19.2	0.60	69	16.28	82.8	1.071	S. 14° E.	4.4
1,250	878.8	17.8	0.56	69	15.04	80.9	1.046	S. 5° E.	4.0
1,500	853.5	16.1	0.68	68	13.51	79.1	1.022	S. 7° E.	3.9
2,000	804.7	13.4	0.54	61	10.29	75.3	0.974	S. 7° E.	3.8
2,500	758.2	11.0	0.48	52	7.59	71.7	0.927	S. 5° W.	3.0
3,000	713.7	8.4	0.52	40	5.47	68.1	0.881	S. 38° W.	3.9
3,500	672.1	6.2	0.44	31	4.43	64.7	0.836	S. 52° W.	7.9
4,000	632.3	4.0	0.44	31	4.19	61.4	0.793	S. 52° W.	7.6

July.

0	1,015.4	28.8	.....	75	28.50	89.7	1.160	.....	.....
141	999.4	27.4	.....	75	27.08	88.7	1.147	S. 15° W.	3.3
250	987.3	26.4	0.92	75	25.84	88.0	1.138	S. 18° W.	4.0
500	959.6	24.3	0.84	76	23.07	86.2	1 114	S. 25° W.	5 7
750	932.6	23.0	0.52	72	20.09	84.2	1.089	S. 29° W.	6.1
1,000	906.2	21.7	0.52	68	17.57	82.2	1.064	S. 32° W.	5.5
1,250	880.6	20.2	0.60	68	16.06	80.4	1.039	S. 31° W.	5.4
1,500	855.5	18.7	0.60	68	14.68	78.5	1.015	S. 28° W.	5.9
2,000	807.1	15.7	0.60	68	12.33	74.9	0.968	S. 26° W.	5.1
2,500	760.9	12.7	0.60	66	10.10	71.4	0.923	S. 17° W.	7.3
3,000	717.1	10.3	0.48	56	7.45	67.9	0.878	S. 22° W.	8.0
3,500	674.1	7.5	0.56	42	4.70	64.6	0.835	S. 10° W.	8.6

August.

0	1,015.0	27.4	.....	80	28.25	90.1	1.165	.....	.....
141	999.0	26.1	.....	81	27.10	89.1	1.152	S. 22° W.	3.3
250	986.8	25.1	0.92	82	26.06	88.3	1.142	S. 20° W.	4.3
500	959.0	23.1	0.80	83	23.45	86.4	1.118	S. 22° W.	6.3
750	931.9	22.0	0.44	79	20.84	84.4	1.091	S. 22° W.	6.7
1,000	905.5	20.9	0.44	74	18.21	82.4	1.065	S. 28° W.	7.0
1,250	879.7	19.8	0.44	70	16.15	80.4	1.039	S. 26° W.	7.6
1,500	854.6	18.4	0.56	69	14.62	78.5	1.015	S. 20° W.	6.9
2,000	806.3	15.4	0.60	69	12.19	74.8	0.968	S. 23° W.	6.2
2,500	760.3	12.5	0.58	69	10.14	71.4	0.923	S. 32° W.	5.9
3,000	716.3	9.9	0.52	67	8.28	67.9	0.878	S. 35° W.	5.4
3,500	674.3	7.3	0.52	64	6.54	64.6	0.835	S. 58° W.	4.5
4,000	633.7	3.5	0.76	51	4.18	61.6	0.796	N. 23° W.	14.1

TABLE 4d.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Groesbeck, Tex.*—Continued.

September.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,015.3	25.8	.....	80	25.50	90.7	1.173		
141	999.2	24.2	.....	79	23.85	89.7	1.159	S. 21° E.	1.9
250	987.1	23.4	0.73	78	22.63	88.9	1.150	S. 18° E.	2.4
500	959.0	21.4	0.80	77	19.96	87.1	1.126	S. 16° E.	4.1
750	931.7	19.9	0.60	76	17.89	85.1	1.100	S. 9° E.	4.7
1,000	905.0	18.9	0.40	71	15.73	83.0	1.073	S. 4° E.	4.6
1,250	879.2	17.8	0.44	68	14.05	81.0	1.047	S. 8° E.	4.3
1,500	854.0	16.8	0.40	64	12.55	79.0	1.021	S. 9° E.	3.7
2,000	805.5	14.5	0.46	60	10.07	75.1	0.972	S. 1° W.	3.2
2,500	759.3	12.0	0.50	54	7.72	71.5	0.924	S. 9° E.	2.9
3,000	715.5	9.5	0.50	49	5.97	68.0	0.880	S. 2° W.	2.9
3,500	674.0	7.4	0.42	45	4.89	64.6	0.835	S. 23° W.	2.1
4,000	634.6	5.0	0.48	39	4.11	61.4	0.793	S. 40° E.	1.7

October.

0	1,015.6	21.0	.....	80	20.30	92.4	1.194		
141	999.2	20.1	.....	80	19.36	91.2	1.179	S. 29° E.	1.4
250	986.9	19.5	0.55	80	18.63	90.3	1.167	S. 19° E.	2.7
500	958.4	18.1	0.56	79	16.86	88.1	1.139	S. 8° E.	5.2
750	930.8	16.9	0.48	79	15.65	85.9	1.111	S.	5.9
1,000	903.9	15.6	0.52	78	14.17	83.9	1.084	S. 5° W.	6.4
1,250	877.7	14.5	0.44	75	12.73	81.8	1.058	S. 12° W.	6.9
1,500	852.2	13.4	0.44	72	11.27	79.8	1.032	S. 17° W.	7.6
2,000	803.1	11.5	0.38	60	7.91	75.8	0.980	S. 27° W.	7.1
2,500	756.6	9.3	0.44	48	5.65	72.0	0.931	S. 30° W.	6.7
3,000	712.4	7.0	0.46	41	4.19	68.4	0.884	S. 35° W.	7.1
3,500	670.4	5.0	0.40	35	3.08	64.8	0.838	S. 46° W.	5.8
4,000	630.4	2.5	0.50	30	2.15	61.6	0.796	S. 67° W.	3.8
4,500	591.9	−0.7	0.64	30	1.71	58.5	0.757	S. 18° W.	4.6
5,000	555.5	−3.3	0.52	30	1.43	55.4	0.717	N. 45° E.	10.3

November.

0	1,020.6	12.6	.....	79	12.20	95.8	1.239		
141	1,003.6	12.2	.....	76	11.54	94.4	1.221	N. 22° E.	0.9
250	990.9	11.8	0.37	74	11.08	93.4	1.207	N. 53° E.	1.0
500	961.5	10.9	0.36	70	10.01	90.9	1.175	S. 33° E.	0.2
750	933.1	10.2	0.28	65	8.94	88.4	1.144	S. 56° W.	1.2
1,000	905.5	9.7	0.20	61	8.01	86.0	1.122	S. 71° W.	2.4
1,250	878.8	9.2	0.20	56	6.90	83.6	1.082	S. 71° W.	2.9
1,500	852.8	8.6	0.24	53	6.03	81.4	1.052	S. 79° W.	3.7
2,000	802.9	6.7	0.38	48	4.69	77.2	0.998	W.	5.8
2,500	755.6	4.6	0.42	44	3.71	73.2	0.946	N. 89° W.	8.2
3,000	710.9	2.2	0.48	43	2.97	69.5	0.898	N. 82° W.	9.2
3,500	668.3	−0.6	0.56	42	2.45	66.0	0.854	S. 88° W.	14.2
4,000	628.1	−1.8	0.24	24	1.03	62.4	0.806	N. 88° W.	12.2
4,500	590.1	−4.8	0.60	22	0.71	59.2	0.766	W.	14.6
5,000	553.7	−8.1	0.66	28	0.67	56.3	0.728	W.	17.3

December.

0	1,020.1	8.8	.....	80	9.60	97.2	1.256		
141	1,002.9	8.8	.....	76	9.26	95.5	1.235	N. 74° W.	1.2
250	989.9	8.8	0.00	73	8.93	94.3	1.220	S. 72° W.	1.5
500	960.3	8.5	0.12	67	8.04	91.6	1.185	S. 48° W.	3.2
750	931.8	8.4	0.04	61	7.18	89.0	1.150	S. 49° W.	5.0
1,000	904.1	8.2	0.08	54	6.20	86.4	1.117	S. 50° W.	6.3
1,250	877.3	7.6	0.24	50	5.38	84.0	1.086	S. 60° W.	7.5
1,500	851.2	6.7	0.36	47	4.71	81.8	1.058	S. 64° W.	8.2
2,000	801.1	4.9	0.36	40	3.49	77.5	1.003	S. 71° W.	9.4
2,500	753.5	2.7	0.44	36	2.79	73.5	0.951	S. 78° W.	10.1
3,000	708.5	0.4	0.46	34	2.37	69.7	0.902	S. 74° W.	11.6
3,500	666.2	−2.1	0.50	32	1.94	66.2	0.856	S. 76° W.	12.7
4,000	625.7	−4.5	0.48	33	1.77	62.7	0.811	S. 73° W.	10.0
4,500	587.1	−6.1	0.32	30	1.59	59.2	0.765	N. 73° W.	10.0

Spring.

0	1,014.0	19.4	.....	69	16.08	92.9	1.201		
141	997.5	18.3	.....	69	15.15	91.7	1.186	S. 1° E.	2.1
250	985.0	17.5	0.73	70	14.43	90.8	1.175	S. 1° E.	2.8
500	956.4	15.7	0.72	70	12.80	88.8	1.148	S. 6° W.	4.4
750	928.7	14.5	0.48	68	11.40	86.6	1.120	S. 15° W.	5.0
1,000	901.6	13.4	0.44	64	10.02	84.4	1.092	S. 26° W.	5.5
1,250	875.3	12.5	0.36	59	8.68	82.3	1.054	S. 35° W.	5.7
1,500	849.6	11.6	0.36	55	7.46	80.2	1.036	S. 41° W.	6.2
2,000	800.3	9.4	0.44	48	5.51	76.1	0.984	S. 49° W.	6.8
2,500	753.4	6.9	0.50	45	4.33	72.4	0.936	S. 58° W.	8.6
3,000	709.0	4.4	0.50	41	3.41	68.7	0.889	S. 66° W.	10.3
3,500	666.7	1.6	0.56	43	2.84	65.3	0.844	S. 67° W.	11.7
4,000	626.3	−1.6	0.64	46	2.64	62.1	0.803	S. 87° W.	15.2
4,500	589.2	−3.2	0.32	46	2.59	58.7	0.759	S. 85° W.	14.6
5,000	552.9	−4.8	0.32	46	2.55	55.4	0.717	N. 67° W.	19.1

TABLE 4d.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Groesbeck, Tex.*—Continued.

Summer.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density		Resultant wind.	
								Direction.	Velocity
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,015.1	27.7	.....	75	26.92	90.0	1.164		
141	999.1	26.3	.....	76	25.67	89.1	1.152	S. 7° W.	2.8
250	986.9	25.3	0.92	76	24.57	88.3	1.142	S. 7° W.	3.5
500	959.1	23.2	0.84	76	22.06	86.5	1.118	S. 14° W.	4.2
750	932.0	21.9	0.52	73	19.61	84.5	1.092	S. 15° W.	5.4
1,000	905.5	20.6	0.52	70	17.35	82.5	1.067	S. 19° W.	5.4
1,250	879.7	19.3	0.52	69	15.75	80.5	1.041	S. 20° W.	5.4
1,500	854.5	17.8	0.60	68	14.27	78.7	1.017	S. 19° W.	5.5
2,000	806.0	14.9	0.58	66	11.60	75.0	0.970	S. 17° W.	5.0
2,500	759.8	12.1	0.56	62	9.27	71.5	0.924	S. 22° W.	5.0
3,000	715.7	9.6	0.50	54	7.06	68.0	0.879	S. 32° W.	5.3
3,500	673.5	7.1	0.50	45	5.22	64.6	0.835	S. 38° W.	6.6
4,000	633.3	4.1	0.60	39	3.92	61.4	0.794	N. 79° W.	5.9

Autumn.

0	1,017.2	19.8	.....	80	19.33	92.9	1.202		
141	1,000.7	18.8	.....	78	18.25	91.8	1.186	S. 46° E.	0.7
250	988.3	18.2	0.55	77	17.45	90.8	1.174	S. 36° E.	1.5
500	959.6	16.8	0.56	75	15.61	88.7	1.146	S. 12° E.	2.9
750	931.8	15.7	0.44	73	14.16	86.5	1.118	S. 4° W.	3.5
1,000	904.7	14.8	0.36	70	12.64	84.2	1.089	S. 16° W.	3.8
1,250	878.5	13.9	0.36	66	11.23	82.1	1.061	S. 21° W.	4.0
1,500	852.9	13.0	0.36	63	9.95	80.0	1.034	S. 30° W.	4.3
2,000	803.7	11.0	0.42	56	7.56	76.0	0.982	S. 49° W.	4.5
2,500	757.0	8.7	0.46	49	5.70	72.2	0.933	S. 58° W.	5.1
3,000	712.8	6.3	0.48	45	4.38	68.6	0.887	S. 65° W.	5.4
3,500	670.8	4.0	0.46	41	3.48	65.1	0.842	S. 65° W.	6.1
4,000	630.9	2.0	0.40	31	2.44	61.7	0.798	S. 77° W.	4.5
4,500	592.7	−1.1	0.62	30	2.06	58.6	0.758	S. 63° W.	9.8
5,000	556.3	−4.1	0.60	33	1.90	55.7	0.720	N. 54° W.	6.2

Winter.

0	1,020.8	9.2	.....	80	9.76	97.1	1.256		
141	1,003.5	8.6	.....	77	9.03	95.7	1.237	N. 45° W.	1.3
250	990.5	8.3	0.28	74	8.63	94.5	1.222	N. 64° W.	1.1
500	960.7	7.4	0.36	70	7.80	92.0	1.190	S. 67° W.	2.0
750	932.0	7.1	0.12	65	7.13	89.4	1.156	S. 63° W.	3.3
1,000	904.1	6.9	0.08	59	6.31	86.8	1.122	S. 64° W.	4.3
1,250	877.1	6.3	0.24	54	5.51	84.4	1.091	S. 74° W.	5.4
1,500	850.8	5.6	0.28	50	4.75	82.1	1.061	S. 82° W.	6.2
2,000	800.5	3.9	0.34	44	3.71	77.8	1.005	S. 87° W.	7.6
2,500	752.8	1.8	0.42	41	3.05	73.7	0.953	S. 87° W.	8.5
3,000	707.6	−0.5	0.46	37	2.57	69.9	0.903	S. 85° W.	10.7
3,500	664.7	−2.8	0.46	34	2.03	66.2	0.856	S. 85° W.	12.4
4,000	624.1	−5.5	0.54	31	1.68	62.8	0.812	N. 71° W.	10.0
4,500	585.5	−7.6	0.42	29	1.54	59.4	0.768	N. 67° W.	10.0
5,000	549.0	−11.0	0.68	.....	.....	56.4	0.730	N. 72° W.	16.9

Annual.

0	1,016.8	19.0	.....	76	18.02	93.2	1.205		
141	1,000.2	18.0	.....	75	17.02	92.0	1.190	S. 8° W.	1.0
250	987.7	17.3	0.64	74	16.27	91.1	1.178	S. 4° W.	1.6
500	959.0	15.7	0.64	73	14.57	89.0	1.151	S. 12° W.	3.2
750	931.2	14.7	0.40	70	13.08	86.8	1.122	S. 22° W.	4.0
1,000	904.1	13.8	0.36	66	11.58	84.5	1.093	S. 31° W.	4.4
1,250	877.8	12.9	0.36	62	10.29	82.4	1.065	S. 39° W.	4.8
1,500	852.1	11.9	0.40	59	9.11	80.3	1.038	S. 46° W.	5.0
2,000	802.8	9.7	0.44	53	7.10	76.2	0.986	S. 58° W.	5.5
2,500	755.9	7.3	0.48	49	5.59	72.4	0.937	S. 65° W.	6.6
3,000	711.4	4.9	0.48	44	4.36	68.8	0.890	S. 70° W.	8.2
3,500	669.0	2.4	0.50	41	3.40	65.3	0.844	S. 73° W.	9.2
4,000	628.7	−0.2	0.52	37	2.68	62.0	0.802	N. 83° W.	8.4
4,500	590.5	−2.6	0.48	36	2.46	58.7	0.759	N. 87° W.	10.2
5,000	554.1	−5.3	0.54	38	2.34	55.7	0.720	N. 68° W.	14.4

TABLE 4e.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Leesburg, Ga.*

January.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,023.2	14.9	.....	67	12.10	95.3	1.232		
85	1,013.0	14.2	.....	68	11.68	94.6	1.223	S. 4° W.	1.0
250	993.5	12.8	0.85	69	11.00	93.3	1.206	S. 18° E.	1.5
500	964.3	11.5	0.52	69	10.15	91.0	1.176	S. 7° W.	2.7
750	936.0	10.6	0.36	67	9.35	88.6	1.146	S. 19° W.	3.6
1,000	908.5	9.8	0.32	65	8.55	86.2	1.115	S. 38° W.	4.7
1,250	881.5	8.8	0.40	62	7.61	84.0	1.086	S. 47° W.	4.6
1,500	855.4	8.0	0.32	59	6.76	81.8	1.057	S. 68° W.	4.7
2,000	804.9	6.8	0.24	46	4.68	77.3	1.000	S. 73° W.	7.4
2,500	757.3	4.4	0.48	43	3.52	73.4	0.949	S. 80° W.	8.1
3,000	712.2	1.9	0.50	39	2.62	69.7	0.901	S. 71° W.	10.1
3,500	669.4	−0.7	0.52	36	2.04	66.1	0.855	S. 64° W.	12.5
4,000	629.6	−3.7	0.60	35	1.50	62.9	0.813	N. 88° W.	13.6

TABLE 4e.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Leesburg, Ga.*—Con.

February.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,017.0	12.9	.....	62	9.80	95.5	1.235	.....	.....
85	1,006.8	12.1	.....	62	9.31	94.8	1.226	N. 72° W.	2.7
250	987.3	10.4	1.03	63	8.53	93.5	1.210	N. 87° W.	3.4
500	958.1	8.4	0.80	64	7.58	91.4	1.182	N. 89° W.	4.2
750	929.3	7.0	0.56	65	7.17	89.2	1.153	W.	5.3
1,000	901.1	5.7	0.52	64	6.39	86.9	1.124	N. 65° W.	7.3
1,250	873.7	4.9	0.32	61	5.71	84.5	1.092	N. 68° W.	8.5
1,500	847.4	4.8	0.04	53	4.94	82.0	1.060	N. 63° W.	9.9
2,000	796.8	2.9	0.38	48	3.94	77.7	1.004	N. 64° W.	13.0
2,500	749.0	1.0	0.38	45	3.33	73.5	0.951	N. 70° W.	14.5
3,000	703.3	−1.1	0.42	48	2.83	69.6	0.900	N. 74° W.	16.2
3,500	660.5	−3.4	0.46	48	1.88	65.9	0.852	N. 66° W.	17.1

March.

0	1,021.2	16.8	.....	56	11.23	94.5	1.222	.....	.....
85	1,011.1	15.8	.....	57	10.86	94.0	1.215	S. 81° E.	0.4
250	991.6	14.1	1.03	58	10.06	92.7	1.199	S. 45° E.	1.3
500	962.7	11.7	0.96	60	8.91	90.8	1.174	S. 34° E.	2.3
750	934.2	10.3	0.56	58	7.98	88.6	1.145	S. 15° E.	3.7
1,000	906.3	9.3	0.40	56	7.37	86.2	1.115	S. 45° W.	3.5
1,250	879.1	9.3	0.00	51	6.71	83.6	1.082	S. 67° W.	4.5
1,500	852.7	8.5	0.32	49	6.13	81.4	1.052	S. 83° W.	4.7
2,000	801.8	7.3	0.24	40	4.71	76.9	0.994	S. 71° W.	7.8
2,500	754.1	4.8	0.50	44	4.28	73.0	0.944	S. 86° W.	10.7
3,000	708.7	2.0	0.56	46	3.65	69.3	0.896	S. 82° W.	11.4
3,500	665.4	−0.5	0.50	37	2.71	65.7	0.849	S. 89° W.	12.7
4,000	625.6	−4.1	0.72	47	2.28	62.6	0.809	N. 80° W.	11.7
4,500	586.7	−7.5	0.68	58	1.81	59.5	0.769	S. 68° W.	14.7

April.

0	1,014.1	20.9	.....	59	15.60	92.4	1.195	.....	.....
85	1,004.2	19.9	.....	60	15.06	91.8	1.188	S. 38° W.	2.2
250	985.0	18.1	1.09	62	13.97	90.7	1.173	S. 29° W.	2.9
500	953.7	15.7	0.96	64	12.59	88.6	1.145	S. 37° W.	4.3
750	926.0	14.0	0.68	66	11.43	86.5	1.119	S. 44° W.	5.4
1,000	899.0	11.4	0.64	66	10.22	84.8	1.096	S. 51° W.	7.0
1,250	872.6	9.8	0.64	65	8.89	82.8	1.071	S. 54° W.	7.4
1,500	846.8	8.9	0.36	59	7.42	80.7	1.043	S. 57° W.	8.7
2,000	796.2	8.0	0.18	44	4.77	76.2	0.985	S. 76° W.	11.8
2,500	749.2	5.5	0.50	45	4.47	72.3	0.935	S. 84° W.	13.4
3,000	704.5	3.6	0.38	32	2.91	68.5	0.886	S. 88° W.	16.5
3,500	661.7	0.9	0.54	31	2.44	65.0	0.841	S. 68° W.	19.3
4,000	621.3	−1.7	0.52	29	1.97	61.6	0.797	S. 55° W.	19.5
4,500	584.1	−4.1	0.48	34	1.96	58.5	0.756	S. 68° W.	18.0

May.

0	1,015.8	25.5	.....	63	20.00	91.0	1.177	.....	.....
85	1,006.0	24.3	.....	64	19.03	90.5	1.171	S. 55° E.	1.1
250	987.2	22.3	1.21	66	17.26	89.5	1.157	S. 36° E.	1.4
500	959.1	20.0	0.92	69	15.73	87.6	1.133	S. 21° E.	2.0
750	931.6	18.3	0.68	71	14.70	85.6	1.108	S. 31° E.	2.6
1,000	904.7	16.5	0.72	74	13.72	83.7	1.082	S. 24° E.	3.1
1,250	878.4	15.0	0.60	77	12.99	81.7	1.057	S. 12° E.	4.4
1,500	852.9	13.4	0.64	79	12.09	79.8	1.032	S. 10° E.	3.4
2,000	803.7	10.7	0.60	75	9.38	76.1	0.984	N. 86° W.	3.7
2,500	757.0	7.4	0.60	72	7.24	72.5	0.937	N. 76° W.	4.4
3,000	712.5	4.4	0.60	78	6.27	69.0	0.892	N. 81° W.	7.0
3,500	670.6	1.4	0.60	84	6.33	65.6	0.848	W.	10.7
4,000	630.9	−2.2	0.72	90	6.16	62.5	0.808	W.	12.0
4,500	591.9	−5.5	0.66	.....	.....	59.4	0.768	W.	13.4

June.

0	1,017.7	28.8	.....	58	22.60	90.1	1.165	.....	.....
85	1,008.0	27.8	.....	59	21.68	89.6	1.158	N. 70° E.	1.1
250	989.3	25.8	1.21	61	20.01	88.5	1.144	N. 84° E.	2.0
500	961.6	23.3	1.00	64	18.16	86.8	1.122	N. 86° E.	2.8
750	934.4	21.2	0.84	67	16.85	85.0	1.099	S. 87° E.	3.0
1,000	907.7	19.3	0.77	69	15.56	83.1	1.075	S. 73° E.	3.5
1,250	881.6	17.5	0.72	70	14.14	81.3	1.051	S. 72° E.	3.7
1,500	856.2	15.8	0.68	71	12.83	79.4	1.027	S. 74° E.	3.6
2,000	806.9	12.8	0.60	70	10.62	75.7	0.978	S. 74° E.	4.2
2,500	760.2	10.3	0.50	60	7.76	72.0	0.931	S. 74° E.	4.3
3,000	715.8	8.1	0.44	55	6.75	68.4	0.884	S. 35° E.	2.2
3,500	673.8	5.7	0.48	41	4.84	65.0	0.840	S. 20° W.	2.0
4,000	633.9	3.8	0.38	39	4.07	61.5	0.795	S. 21° W.	6.3

July.

0	1,016.9	28.5	.....	68	26.50	90.0	1.164	.....	.....
85	1,007.2	27.5	.....	70	25.56	89.4	1.157	S. 7° W.	2.4
250	988.7	25.4	1.27	74	23.85	88.4	1.144	S. 3° W.	3.5
500	961.0	23.0	0.96	78	21.94	86.7	1.121	S. 1° E.	4.4
750	933.9	21.1	0.76	81	20.44	84.8	1.097	S. 1° W.	4.9
1,000	907.3	19.5	0.64	82	18.95	82.9	1.072	S. 18° E.	7.0

TABLE 4e.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Leesburg, Ga.*—Con.

July—Continued.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
1,250	881.2	18.4	0.44	79	17.16	80.9	1.046	S. 26° E.	6.7
1,500	855.7	17.3	0.44	76	15.54	78.9	1.020	S. 28° E.	7.6
2,000	806.4	15.3	0.40	67	12.34	74.9	0.969	S. 29° E.	7.8
2,500	759.7	12.7	0.52	67	10.79	71.3	0.921	S. 23° E.	7.6
3,000	715.3	10.2	0.50	67	9.58	67.7	0.876	S. 31° E.	8.0
3,500	674.1	7.2	0.60	74	9.16	64.5	0.834	S. 11° E.	5.4
4,000	635.1	4.3	0.58	73	8.55	61.4	0.794	E.	6.9

August.

0	1,016.9	31.5	.....	62	28.60	89.0	1.151	.....	.....
85	1,007.3	30.6	.....	63	27.33	88.5	1.144	S. 67° W.	4.1
250	988.7	28.8	1.09	65	25.30	87.4	1.130	S. 66° W.	5.0
500	961.4	25.9	1.16	70	23.41	85.9	1.110	S. 54° W.	6.1
750	934.4	23.1	1.12	78	22.42	84.2	1.089	S. 46° W.	5.6
1,000	907.6	19.9	1.28	84	20.26	82.8	1.070	S. 68° W.	6.7
1,250	881.2	16.3	1.44	87	17.93	81.4	1.053	S. 68° W.	7.6
1,500	856.5	14.4	0.76	85	15.23	79.8	1.031	W.	9.3
2,000	808.4	10.8	0.72	85	11.97	76.3	0.987	W.	9.6
2,500	761.9	7.7	0.62	87	9.91	72.8	0.941	N. 68° W.	9.8

September.

0	1,018.2	28.4	.....	56	20.80	90.3	1.168	.....	.....
85	1,008.5	26.8	.....	58	19.60	90.0	1.163	N. 74° E.	4.3
250	989.9	24.0	1.70	61	17.94	89.2	1.153	N. 72° E.	6.1
500	961.9	21.3	1.08	63	15.93	87.5	1.132	N. 70° E.	7.3
750	934.7	19.5	0.72	62	14.35	85.6	1.107	N. 70° E.	7.4
1,000	907.6	18.2	0.52	61	12.62	83.5	1.080	N. 67° E.	8.5
1,250	881.6	16.9	0.52	61	11.49	81.5	1.054	N. 64° E.	8.0
1,500	856.2	15.3	0.64	60	10.27	79.6	1.030	N. 70° E.	8.1
2,000	806.7	12.7	0.52	52	7.65	75.8	0.980	N. 76° E.	7.7
2,500	760.5	10.3	0.48	47	5.97	72.1	0.932	N. 79° E.	8.1
3,000	716.5	8.1	0.44	39	4.09	68.5	0.886	N. 68° E.	9.1
3,500	674.1	5.1	0.60	33	2.49	65.2	0.843	N. 55° E.	9.8

October.

0	1,018.6	27.4	.....	70	24.30	90.5	1.171	.....	.....
85	1,008.9	26.2	.....	71	23.45	90.0	1.164	S. 56° E.	1.4
250	990.3	24.4	1.09	73	22.07	89.0	1.150	S. 53° E.	2.4
500	962.2	22.1	0.92	77	20.51	87.1	1.127	S. 61° E.	3.8
750	934.8	20.5	0.64	79	19.06	85.1	1.101	S. 46° E.	3.5
1,000	908.0	18.7	0.72	81	17.49	83.2	1.076	S. 40° E.	2.7
1,250	881.9	17.1	0.64	83	16.04	81.3	1.052	S. 55° E.	2.9
1,500	856.6	15.4	0.68	80	13.85	79.5	1.028	S. 51° E.	3.3
2,000	807.4	12.7	0.54	68	9.81	75.8	0.980	S. 29° E.	3.7
2,500	760.4	10.3	0.48	56	6.84	72.1	0.932	S. 36° E.	4.0
3,000	716.3	8.6	0.34	54	5.79	68.3	0.883	S.	1.8
3,500	673.9	6.2	0.48	54	4.82	64.8	0.838	S. 35° W.	2.2
4,000	633.6	3.2	0.60	59	4.32	61.6	0.797	S. 35° W.	14.2

November.

0	1,020.5	18.1	.....	59	12.30	94.0	1.216	.....	.....
85	1,010.4	17.6	.....	60	12.14	93.2	1.206	N. 85° E.	0.9
250	991.1	16.6	0.61	61	11.82	91.8	1.187	S. 64° E.	1.8
500	962.4	15.5	0.44	63	11.35	89.5	1.157	S. 51° E.	2.7
750	934.4	14.2	0.52	64	10.44	87.3	1.129	S. 14° E.	2.3
1,000	907.2	12.8	0.56	65	9.56	85.2	1.102	S. 10° W.	2.3
1,250	880.6	11.8	0.40	62	8.46	83.0	1.073	S. 22° W.	3.0
1,500	854.8	10.8	0.40	58	7.59	80.9	1.046	S. 40° W.	3.4
2,000	805.0	8.7	0.42	55	5.92	76.8	0.993	S. 68° W.	5.6
2,500	757.8	7.0	0.34	46	4.20	72.8	0.941	S. 79° W.	6.9
3,000	713.1	5.2	0.36	40	3.05	68.9	0.891	S. 83° W.	11.0
3,500	670.9	2.9	0.46	43	2.73	65.4	0.846	S. 85° W.	12.3
4,000	630.8	0.6	0.46	45	2.44	62.0	0.802	S. 80° W.	13.8
4,500	593.1	−1.1	0.34	42	1.88	58.7	0.759	S. 79° W.	13.1

December.

0	1,022.5	12.4	.....	62	9.37	96.2	1.244	.....	.....
85	1,012.2	11.7	.....	62	9.00	95.5	1.234	N. 44° W.	1.8
250	992.4	10.6	0.67	61	8.32	94.0	1.215	N. 47° W.	2.2
500	963.0	9.2	0.56	59	7.42	91.7	1.185	N. 59° W.	1.9
750	934.4	8.7	0.20	55	6.70	89.1	1.152	N. 82° W.	3.1
1,000	906.9	8.8	−0.04	52	6.21	86.5	1.118	S. 88° W.	4.7
1,250	880.0	8.2	0.24	51	5.83	84.1	1.088	S. 85° W.	6.4
1,500	854.1	7.4	0.32	50	5.53	81.8	1.058	S. 85° W.	7.3
2,000	803.9	5.8	0.32	47	4.55	77.5	1.002	S. 86° W.	11.3
2,500	756.5	3.9	0.38	44	3.87	73.5	0.950	S. 87° W.	12.6
3,000	711.4	1.9	0.40	42	3.32	69.6	0.900	N. 77° W.	12.9
3,500	668.4	0.0	0.38	35	2.35	65.9	0.852	N. 67° W.	15.6
4,000	627.8	−2.8	0.56	34	1.72	62.5	0.808	N. 79° W.	14.7
4,500	589.8	−5.9	0.62	35	1.60	59.4	0.768	N. 74° W.	17.3
5,000	551.8	.....	.....	34	.....	.....	.....	N. 45° W.	16.0

TABLE 4e.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants at Leesburg, Ga.*—Con.

Spring.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,017.0	21.1	.....	59	15.61	92.6	1.198	.....	.....
85	1,007.1	20.0	.....	60	14.98	92.1	1.190	S. 10° W.	0.9
250	987.9	18.2	1.09	62	13.76	90.9	1.175	S. 2° W.	1.6
500	958.5	15.8	0.96	64	12.41	89.0	1.151	S. 9° W.	2.5
750	930.6	14.2	0.64	65	11.37	86.9	1.124	S. 15° W.	3.5
1,000	903.3	12.7	0.60	65	10.44	84.8	1.097	S. 37° W.	4.3
1,250	876.7	11.7	0.40	64	9.53	82.6	1.068	S. 44° W.	5.1
1,500	850.8	10.6	0.44	62	8.55	80.5	1.041	S. 54° W.	5.6
2,000	800.6	8.9	0.34	53	6.29	76.3	0.987	S. 77° W.	8.0
2,500	753.5	6.2	0.54	54	5.33	72.5	0.938	S. 87° W.	10.0
3,000	708.6	3.6	0.52	52	4.28	68.9	0.890	S. 87° W.	12.8
3,500	665.9	0.9	0.54	51	3.83	65.4	0.845	S. 78° W.	14.8
4,000	625.9	−2.4	0.66	56	3.47	62.2	0.804	S. 81° W.	13.0
4,500	587.2	−5.4	0.60	64	3.23	59.0	0.763	S. 74° W.	15.2

Summer.

0	1,017.2	29.6	.....	63	25.90	89.7	1.160	.....	.....
85	1,007.5	28.6	.....	64	24.86	89.2	1.153	S. 31° E.	0.7
250	988.9	26.6	1.21	67	23.06	88.2	1.140	S. 43° E.	1.4
500	961.3	24.0	1.04	71	21.18	86.5	1.118	S. 48° E.	2.0
750	934.2	21.7	0.92	76	19.91	84.7	1.096	S. 43° E.	2.5
1,000	907.5	19.5	0.88	79	18.26	83.0	1.072	S. 46° E.	3.5
1,250	881.3	17.3	0.88	79	16.41	81.2	1.050	S. 48° E.	4.0
1,500	856.1	15.7	0.64	78	14.53	79.4	1.026	S. 53° E.	3.8
2,000	807.2	12.8	0.58	75	11.64	75.7	0.978	S. 55° E.	4.2
2,500	760.6	10.1	0.54	72	9.48	72.0	0.932	S. 55° E.	3.8
3,000	716.2	7.7	0.48	70	8.37	68.4	0.885	S. 29° E.	2.9
3,500	674.6	5.0	0.54	66	7.21	65.1	0.842	S. 2° W.	3.0
4,000	635.2	2.6	0.48	64	6.52	61.9	0.800	S. 1° E.	4.4

Autumn.

0	1,019.1	24.6	.....	62	19.13	91.6	1.184	.....	.....
85	1,009.3	23.5	.....	63	18.40	91.1	1.177	N. 83° E.	2.0
250	990.5	21.6	1.15	65	17.28	90.0	1.164	S. 89° E.	3.0
500	962.2	19.6	0.80	68	15.93	88.0	1.138	S. 81° E.	3.6
750	934.7	18.0	0.64	69	14.62	86.0	1.112	S. 75° E.	3.1
1,000	907.7	16.5	0.60	70	13.23	84.0	1.086	S. 76° E.	2.5
1,250	881.5	15.2	0.52	70	12.00	82.0	1.060	S. 72° E.	2.1
1,500	856.0	13.8	0.56	67	10.57	80.0	1.035	S. 49° E.	1.6
2,000	806.5	11.3	0.50	59	7.79	76.2	0.985	S. 24° W.	1.1
2,500	759.7	9.1	0.44	50	5.67	72.4	0.936	S. 49° W.	1.3
3,000	715.4	7.2	0.38	45	4.31	68.6	0.887	S. 86° W.	4.8
3,500	673.1	4.6	0.52	44	3.35	65.8	0.851	S. 87° W.	7.3
4,000	632.9	2.0	0.52	48	2.95	61.9	0.800	S. 67° W.	13.1
4,500	595.2	0.3	0.34	45	2.39	58.6	0.758	S. 69° W.	14.2

Winter.

0	1,020.9	13.4	.....	64	10.42	95.7	1.237	.....	.....
85	1,010.7	12.7	.....	64	10.00	94.9	1.228	N. 70° W.	1.5
250	991.1	11.3	0.85	64	9.29	93.6	1.210	N. 83° W.	1.6
500	961.8	9.7	0.64	64	8.39	91.4	1.181	S. 80° W.	2.1
750	933.2	8.8	0.36	62	7.75	88.9	1.150	S. 74° W.	3.4
1,000	905.5	8.1	0.28	60	7.06	86.5	1.119	S. 85° W.	4.6
1,250	878.4	7.3	0.32	58	6.39	84.2	1.089	S. 87° W.	5.8
1,500	852.3	6.7	0.24	54	5.75	81.9	1.059	N. 86° W.	6.8
2,000	801.9	5.1	0.32	47	4.40	77.5	1.002	N. 85° W.	9.9
2,500	754.3	3.0	0.42	44	3.58	73.5	0.950	N. 85° W.	11.2
3,000	709.0	0.8	0.44	43	2.93	69.6	0.901	N. 84° W.	12.7
3,500	666.1	−1.5	0.46	40	2.10	66.0	0.854	N. 80° W.	13.9
4,000	625.9	−4.4	0.58	39	1.52	62.7	0.811	N. 80° W.	14.2
4,500	587.9	−7.5	0.62	40	1.40	59.6	0.771	N. 89° W.	14.0
5,000	549.9	.....	.....	39	.....	.....	.....	N. 45° W.	16.0

Annual.

0	1,018.6	22.2	.....	62	17.77	92.4	1.194	.....	.....
85	1,008.6	21.2	.....	63	17.06	91.8	1.187	S. 5° E.	0.2
250	989.6	19.4	1.09	65	15.85	90.6	1.172	S. 23° E.	0.8
500	961.0	17.3	0.84	67	14.48	88.7	1.146	S. 13° E.	1.3
750	933.2	15.7	0.64	68	13.41	86.6	1.120	S. 7° W.	1.9
1,000	906.0	14.2	0.60	68	12.24	84.6	1.094	S. 34° W.	2.2
1,250	879.5	12.9	0.52	67	11.08	82.5	1.067	S. 48° W.	2.8
1,500	853.8	11.7	0.48	65	9.85	80.4	1.040	S. 64° W.	3.2
2,000	804.0	9.5	0.44	58	7.53	76.4	0.987	S. 80° W.	4.8
2,500	757.0	7.1	0.48	55	6.02	72.6	0.938	S. 87° W.	6.6
3,000	712.3	4.9	0.44	52	4.98	68.9	0.890	S. 89° W.	8.7
3,500	669.9	2.3	0.52	50	4.16	65.4	0.846	S. 87° W.	9.9
4,000	629.9	−0.6	0.58	52	3.67	62.2	0.804	S. 78° W.	11.0
4,500	591.6	−3.4	0.56	56	3.38	59.0	0.763	S. 73° W.	11.9
5,000	553.6	.....	.....	55	.....	.....	.....	N. 86° W.	16.1

TABLE 4f.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants, at Royal Center, Ind.*

January.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,022.6	−3.5	.....	86	4.82	102.1	1.320	.....	.....
225	993.8	−4.4	.....	82	4.06	99.5	1.287	S. 58° W.	2.4
250	990.6	−4.5	0.40	81	3.92	99.2	1.283	S. 59° W.	2.3
500	959.6	−5.4	0.36	76	3.43	96.5	1.248	S. 62° W.	4.4
750	929.4	−5.6	0.08	71	3.12	92.4	1.195	S. 66° W.	6.6
1,000	900.2	−5.5	−0.04	63	2.68	90.6	1.171	S. 73° W.	8.0
1,250	871.9	−5.4	−0.04	55	2.35	87.7	1.134	S. 77° W.	9.4
1,500	844.5	−5.6	0.08	49	2.05	85.0	1.099	S. 80° W.	10.4
2,000	792.1	−6.5	0.18	42	1.66	80.0	1.035	S. 79° W.	12.4
2,500	742.9	−7.9	0.28	42	1.52	75.4	0.975	N. 89° W.	15.1
3,000	696.7	−10.3	0.48	47	1.43	71.4	0.923	N. 89° W.	17.1
3,500	653.6	−12.9	0.52	47	0.98	67.6	0.875	S. 67° W.	14.3
4,000	612.8	−15.4	0.50	45	0.60	64.1	0.828	S. 45° W.	22.1

February.

0	1,019.1	−0.3	.....	77	4.87	100.5	1.299	.....	.....
225	990.7	−2.3	.....	77	4.26	98.4	1.273	S. 79° W.	2.1
250	987.5	−2.5	0.80	77	4.19	98.2	1.270	S. 74° W.	2.3
500	956.8	−4.2	0.68	76	3.71	95.8	1.238	S. 54° W.	3.6
750	927.0	−4.9	0.28	73	3.38	93.0	1.203	S. 52° W.	4.8
1,000	897.9	−5.2	0.12	69	3.12	90.2	1.166	S. 63° W.	5.5
1,250	869.7	−5.6	0.16	65	2.76	87.5	1.132	S. 72° W.	7.7
1,500	842.4	−6.2	0.24	62	2.43	85.0	1.099	S. 72° W.	8.9
2,000	790.1	−7.5	0.26	57	1.94	80.1	1.036	S. 78° W.	9.8
2,500	740.8	−9.0	0.30	55	1.64	75.6	0.977	S. 81° W.	11.8
3,000	694.3	−11.0	0.40	56	1.45	71.3	0.922	S. 81° W.	11.6
3,500	650.4	−13.7	0.54	59	1.25	67.5	0.873	S. 89° W.	16.6
4,000	608.4	−15.3	0.52	57	1.13	63.8	0.825	S. 83° W.	17.7

March.

0	1,018.8	7.5	.....	71	7.30	97.6	1.262	.....	.....
225	991.2	4.9	.....	70	6.34	95.9	1.240	S. 44° W.	2.6
250	988.1	4.6	1.20	70	6.23	95.7	1.237	S. 42° W.	3.0
500	958.1	2.5	0.84	68	5.27	93.5	1.209	S. 51° W.	5.7
750	928.9	1.6	0.36	65	4.74	91.0	1.176	S. 53° W.	6.6
1,000	900.6	0.7	0.36	63	4.31	88.5	1.144	S. 57° W.	7.3
1,250	873.1	0.1	0.24	61	3.97	86.0	1.112	S. 65° W.	8.5
1,500	846.2	−0.7	0.32	60	3.76	83.6	1.081	S. 64° W.	9.6
2,000	794.9	−2.5	0.36	57	3.15	79.0	1.022	S. 72° W.	10.6
2,500	746.1	−4.6	0.42	54	2.62	74.4	0.962	S. 79° W.	9.8
3,000	700.1	−7.1	0.50	54	2.34	70.9	0.916	S. 82° W.	11.3
3,500	656.5	−9.7	0.52	52	2.06	67.1	0.868	S. 75° W.	11.2
4,000	614.5	−11.9	0.44	52	1.89	63.3	0.819	S. 86° W.	12.7
4,500	576.2	−14.6	0.54	56	1.77	60.0	0.776	S. 84° W.	13.9
5,000	539.6	−17.7	0.62	54	1.63	56.9	0.735	.....	.....

April.

0	1,013.5	12.7	.....	68	9.90	95.2	1.231	.....	.....
225	986.5	9.5	.....	68	8.56	93.8	1.213	S. 31° W.	2.2
250	983.5	9.2	1.20	68	8.38	93.6	1.210	S. 34° W.	2.4
500	954.2	6.7	1.00	68	7.18	91.7	1.185	S. 35° W.	4.2
750	925.5	5.0	0.68	68	6.38	89.5	1.157	S. 44° W.	5.4
1,000	897.5	3.5	0.60	68	5.88	87.2	1.128	S. 53° W.	6.0
1,250	870.2	2.1	0.56	68	5.33	85.0	1.099	S. 64° W.	6.8
1,500	843.7	1.1	0.40	66	4.77	82.8	1.070	S. 73° W.	7.6
2,000	792.8	−0.6	0.34	59	3.72	78.3	1.012	S. 84° W.	8.8
2,500	744.7	−3.2	0.52	56	2.90	74.2	0.960	S. 87° W.	8.9
3,000	699.7	−6.1	0.58	59	2.32	70.5	0.912	N. 87° W.	11.0
3,500	656.3	−9.0	0.58	64	2.11	66.9	0.865	S. 76° W.	13.5
4,000	615.0	−10.6	0.32	70	1.97	63.1	0.816	N. 69° W.	15.5
4,500	575.7	−13.2	0.52	67	1.41	59.6	0.771	N. 45° W.	18.5
5,000	538.7	−15.2	0.40	53	0.87	56.2	0.727	N. 22° W.	18.6

May.

0	1,017.8	19.1	.....	62	13.80	93.4	1.208	.....	.....
225	991.3	15.6	.....	62	11.46	92.1	1.191	N. 62° E.	2.3
250	988.3	15.3	1.20	62	10.97	92.0	1.189	N. 63° E.	2.2
500	959.6	12.5	1.12	62	9.34	90.2	1.167	N. 74° E.	2.1
750	931.7	10.8	0.68	60	8.22	88.2	1.140	N. 74° E.	1.7
1,000	904.2	9.3	0.60	58	7.29	86.0	1.112	N. 75° E.	1.4
1,250	877.4	8.0	0.52	55	6.34	83.9	1.085	N. 38° E.	1.6
1,500	851.2	6.9	0.44	51	5.52	81.7	1.057	N. 19° E.	1.4
2,000	800.8	5.1	0.36	40	3.88	77.4	1.001	N. 8° E.	2.0
2,500	752.9	3.2	0.38	33	2.73	73.3	0.948	N. 23° W.	2.5
3,000	707.9	0.6	0.52	28	1.82	69.6	0.901	N. 38° W.	4.3
3,500	664.8	−2.2	0.56	26	1.32	66.1	0.854	N. 62° W.	7.8
4,000	623.2	−4.6	0.48	20	0.62	62.5	0.808	N. 83° W.	8.9

June.

0	1,015.3	26.0	.....	64	21.35	90.8	1.174	.....	.....
225	989.6	23.2	.....	64	18.27	89.4	1.156	S. 32° W.	1.2
250	986.7	22.9	1.20	64	17.98	89.2	1.154	S. 32° W.	1.2
500	958.7	20.4	1.00	63	15.39	87.5	1.132	S. 35° W.	2.1
750	931.1	18.5	0.76	64	14.08	85.6	1.106	S. 40° W.	2.6
1,000	904.4	16.7	0.72	65	13.05	83.6	1.082	S. 60° W.	2.9
1,250	878.3	15.0	0.68	66	11.99	81.7	1.057	S. 71° W.	2.9
1,500	852.8	13.5	0.60	65	10.73	79.8	1.032	N. 88° W.	2.9
2,000	803.7	10.7	0.56	61	8.02	76.0	0.983	S. 82° W.	3.5
2,500	757.0	7.9	0.56	49	5.08	72.4	0.936	S. 84° W.	5.7
3,000	712.8	5.1	0.56	41	3.27	68.9	0.891	W.	8.8
3,500	670.5	2.5	0.52	35	2.07	65.5	0.847	N. 80° W.	11.3

TABLE 4f.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants, at Royal Center, Ind.*—Continued.

July.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb.*	*°C.*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
0	1,014.6	27.5	.....	61	22.10	90.2	1.166	.....	.....
225	989.1	25.4	.....	61	19.72	88.6	1.146	S. 81° W.	1.3
250	986.2	25.2	0.80	61	19.41	88.4	1.144	S. 86° W.	1.4
500	958.6	23.1	0.84	61	17.14	86.6	1.120	W.	2.2
750	931.4	21.3	0.72	62	15.23	84.7	1.096	S. 84° W.	3.1
1,000	905.0	19.6	0.68	62	13.85	82.8	1.071	S. 87° W.	3.8
1,250	879.9	18.0	0.64	61	12.39	80.9	1.046	W.	4.7
1,500	853.7	16.4	0.64	61	11.03	79.1	1.022	N. 85° W.	5.1
2,000	804.9	13.6	0.56	56	8.04	75.4	0.975	W.	7.2
2,500	758.4	11.0	0.52	51	5.68	71.8	0.928	N. 84° W.	9.4
3,000	714.2	7.6	0.68	46	4.02	68.4	0.885	S. 85° W.	11.6
3,500	672.1	4.3	0.66	44	3.17	65.2	0.843	S. 77° W.	12.9

August.

0	1,014.7	26.4	.....	67	22.28	90.6	1.171	.....	.....
225	989.1	24.3	.....	65	19.44	89.0	1.150	S. 60° W.	1.7
250	986.1	24.1	0.80	65	19.23	88.8	1.148	S. 61° W.	1.8
500	958.4	22.1	0.80	63	16.89	86.9	1.124	S. 61° W.	3.4
750	931.3	20.4	0.68	63	15.45	85.0	1.099	S. 69° W.	4.1
1,000	904.7	18.9	0.60	63	14.29	83.0	1.073	S. 76° W.	5.3
1,250	878.7	17.4	0.60	64	13.34	81.1	1.048	S. 77° W.	5.7
1,500	853.4	15.8	0.64	64	12.25	79.2	1.024	S. 81° W.	6.5
2,000	804.5	12.9	0.58	61	9.86	75.5	0.976	S. 78° W.	7.4
2,500	758.0	10.3	0.52	57	8.00	71.8	0.928	S. 84° W.	8.2
3,000	713.7	7.7	0.52	50	6.16	68.3	0.883	S. 86° W.	9.7
3,500	671.7	5.1	0.52	46	5.02	64.9	0.839	S. 79° W.	11.2
4,000	631.9	2.5	0.52	47	4.23	61.6	0.797	S. 81° W.	11.8
4,500	593.8	0.0	0.50	50	3.63	58.5	0.756	S. 74° W.	9.6

September.

0	1,017.0	24.0	.....	63	16.72	91.7	1.185	.....	.....
225	991.0	21.4	.....	63	14.89	90.2	1.166	S. 64° W.	1.4
250	988.0	21.2	0.80	63	14.69	90.0	1.163	S. 67° W.	1.6
500	959.6	18.8	0.96	63	12.98	88.2	1.140	S. 63° W.	2.9
750	931.9	17.1	0.64	63	11.79	86.1	1.114	S. 69° W.	3.8
1,000	904.9	15.5	0.64	63	10.62	84.1	1.088	S. 75° W.	4.6
1,250	878.5	13.9	0.64	63	9.58	82.2	1.062	S. 75° W.	5.4
1,500	852.9	12.4	0.60	63	8.49	80.2	1.037	S. 81° W.	5.6
2,000	803.5	9.5	0.58	60	6.36	76.4	0.988	S. 77° W.	7.5
2,500	756.6	7.0	0.50	58	4.51	72.6	0.939	S. 81° W.	8.0
3,000	712.3	4.6	0.48	55	3.36	69.0	0.892	S. 79° W.	10.2
3,500	670.3	2.1	0.50	53	2.16	65.6	0.848	S. 87° W.	9.3
4,000	630.7	−0.4	0.50	51	1.93	62.3	0.805	N. 87° W.	9.2
4,500	592.6	−3.2	0.56	43	1.82	59.1	0.764	S. 68° W.	13.4

October.

0	1,018.2	17.2	.....	69	12.95	94.1	1.216	.....	.....
225	991.6	15.4	.....	67	11.81	92.2	1.192	S. 34° W.	2.4
250	988.7	15.2	0.80	67	11.68	92.0	1.190	S. 34° W.	2.6
500	959.8	13.6	0.64	66	10.35	89.8	1.162	S. 41° W.	4.2
750	931.8	12.2	0.56	64	9.29	87.7	1.134	S. 50° W.	5.5
1,000	904.4	11.0	0.48	63	8.50	85.5	1.105	S. 57° W.	6.3
1,250	877.7	9.8	0.48	61	7.63	83.3	1.078	S. 56° W.	7.4
1,500	851.7	8.6	0.48	58	6.66	81.3	1.051	S. 60° W.	8.3
2,000	801.6	6.4	0.44	52	5.05	77.1	0.997	S. 63° W.	9.1
2,500	754.3	4.2	0.44	47	3.91	73.2	0.946	S. 66° W.	9.7
3,000	709.3	2.1	0.42	42	3.03	69.4	0.897	S. 64° W.	10.8
3,500	667.0	−0.3	0.48	40	2.34	65.8	0.851	S. 73° W.	13.2
4,000	626.9	−2.2	0.38	35	1.53	62.3	0.806	N. 89° W.	12.1

November.

0	1,020.8	6.3	.....	74	7.06	98.2	1.270	.....	.....
225	993.1	4.5	.....	73	6.38	96.2	1.244	S. 66° W.	2.7
250	990.1	4.3	0.80	73	6.30	96.0	1.241	S. 62° W.	3.1
500	960.0	2.7	0.64	72	5.59	93.6	1.210	S. 58° W.	4.8
750	930.7	1.5	0.48	70	4.96	91.2	1.179	S. 65° W.	6.3
1,000	902.3	0.7	0.32	66	4.30	88.7	1.146	S. 69° W.	6.9
1,250	874.7	0.1	0.24	61	3.74	86.2	1.114	S. 68° W.	7.9
1,500	847.9	−0.4	0.20	56	3.29	83.7	1.082	S. 72° W.	8.5
2,000	796.5	−1.9	0.30	52	2.80	79.0	1.022	S. 76° W.	9.5
2,500	748.1	−3.7	0.36	50	2.28	74.8	0.967	S. 73° W.	11.1
3,000	702.6	−5.5	0.36	51	2.06	70.7	0.914	S. 81° W.	12.6
3,500	659.5	−7.7	0.44	56	1.75	66.9	0.865	S. 83° W.	11.4
4,000	618.7	−11.1	0.68	44	0.17	63.6	0.823	S. 78° W.	12.7

December.

0	1,019.3	−0.5	.....	82	5.15	100.6	1.301	.....	.....
225	990.9	−1.8	.....	79	4.64	98.3	1.270	S. 45° W.	2.5
250	987.8	−1.9	0.40	79	4.59	98.0	1.267	S. 49° W.	2.5
500	957.3	−2.9	0.40	75	4.04	95.4	1.233	S. 51° W.	4.8
750	927.5	−3.5	0.24	71	3.60	92.6	1.197	S. 61° W.	6.3
1,000	898.6	−3.5	0.00	65	3.21	89.7	1.160	S. 74° W.	7.2
1,250	870.6	−3.5	0.00	59	2.91	86.9	1.124	S. 80° W.	9.2
1,500	843.7	−3.8	0.12	55	2.60	84.3	1.090	S. 84° W.	10.4

TABLE 4f.—*Mean free-air barometric and vapor pressures, temperatures, relative humidities, densities, and wind resultants, at Royal Center, Ind.*—Continued.

December—Continued.

Altitude, m. s. l.	Pressure.	Temperature.		Relative humidity.	Vapor pressure.	Density.		Resultant wind.	
								Direction.	Velocity.
m.	*mb*	*°C*	*Δt/100 m.*	*%*	*mb.*	*%*	*kg./m.³*		*m. p. s.*
2,000	791.8	−5.2	0.28	49	1.94	79.6	1.029	S. 83° W.	11.3
2,500	742.9	−7.2	0.40	47	1.58	75.2	0.973	S. 79° W.	12.0
3,000	696.8	−9.6	0.48	45	1.29	71.2	0.921	S. 75° W.	13.0
3,500	653.3	−12.4	0.56	48	1.15	67.5	0.873	S. 68° W.	9.8

Spring.

0	1,016.7	13.1	.....	67	10.33	95.4	1.233	.....	.....
225	989.7	10.0	.....	67	8.69	93.9	1.214	S. 25° W.	1.1
250	986.7	9.7	1.20	67	8.53	93.7	1.212	S. 27° W.	1.3
500	957.4	7.2	1.00	66	7.27	91.8	1.187	S. 39° W.	3.0
750	928.8	5.8	0.56	64	6.45	89.4	1.156	S. 46° W.	3.8
1,000	900.9	4.5	0.52	63	5.83	87.3	1.128	S. 53° W.	4.1
1,250	873.7	3.4	0.44	61	5.22	85.0	1.099	S. 67° W.	4.8
1,500	847.2	2.4	0.40	59	4.69	82.7	1.069	S. 70° W.	5.7
2,000	796.3	0.6	0.36	52	3.59	78.3	1.012	S. 81° W.	6.8
2,500	748.0	−1.6	0.44	48	2.76	74.1	0.959	S. 89° W.	6.7
3,000	702.7	−4.3	0.54	47	2.17	70.4	0.910	N. 86° W.	8.6
3,500	659.3	−7.1	0.56	47	1.84	66.7	0.863	S. 86° W.	10.2
4,000	617.7	−9.2	0.42	47	1.50	63.0	0.815	N. 85° W.	12.0
4,500	578.9	−11.8	0.52	47	1.16	59.7	0.772	N. 84° W.	13.5
5,000	542.1	−14.4	0.52	39	0.82	56.4	0.730	N. 22° W.	18.6

Summer.

0	1,014.9	26.6	.....	64	21.91	90.5	1.171	.....	.....
225	989.3	24.3	.....	63	19.14	89.0	1.151	S. 61° W.	1.4
250	986.4	24.1	0.80	63	18.87	88.8	1.148	S. 64° W.	1.4
500	958.6	21.9	0.88	62	16.47	87.0	1.125	S. 64° W.	2.6
750	931.3	20.1	0.72	63	14.92	85.0	1.099	S. 68° W.	3.2
1,000	904.7	18.4	0.68	63	13.73	83.2	1.075	S. 76° W.	4.1
1,250	878.7	16.8	0.64	63	12.57	81.3	1.051	S. 80° W.	4.6
1,500	853.3	15.2	0.64	63	11.33	79.4	1.026	S. 87° W.	5.1
2,000	804.4	12.4	0.56	59	8.63	75.5	0.976	S. 84° W.	6.3
2,500	757.8	9.7	0.54	52	6.24	72.0	0.931	S. 89° W.	7.9
3,000	713.6	6.8	0.58	45	4.47	68.5	0.886	S. 87° W.	10.0
3,500	671.5	4.0	0.56	41	3.41	65.2	0.843	S. 84° W.	11.6
4,000	631.7	1.4	0.52	42	3.15	61.9	0.800	S. 85° W.	11.7
4,500	593.6	−1.1	0.50	45	2.95	58.7	0.759	S. 78° W.	12.9

Autumn.

0	1,018.7	15.8	.....	69	12.24	94.6	1.223	.....	.....
225	991.9	13.8	.....	68	11.03	92.8	1.200	S. 54° W.	2.1
250	988.9	13.6	0.80	68	10.89	92.6	1.197	S. 53° W.	2.4
500	959.8	11.7	0.76	67	9.64	90.5	1.170	S. 53° W.	4.0
750	931.5	10.3	0.56	66	8.68	88.3	1.142	S. 59° W.	5.2
1,000	903.9	9.1	0.48	64	7.81	86.0	1.113	S. 66° W.	5.9
1,250	877.0	8.0	0.44	62	6.99	83.8	1.084	S. 65° W.	6.8
1,500	850.9	6.9	0.44	59	6.15	81.7	1.056	S. 69° W.	7.5
2,000	800.6	4.7	0.44	55	4.74	77.5	1.002	S. 72° W.	8.6
2,500	753.1	2.5	0.44	52	3.57	73.5	0.951	S. 73° W.	9.6
3,000	708.2	0.4	0.42	50	2.82	69.7	0.901	S. 74° W.	11.1
3,500	665.7	−2.0	0.48	50	2.09	66.1	0.855	S. 80° W.	11.3
4,000	625.5	−4.6	0.52	44	1.22	63.0	0.814	S. 87° W.	8.2
4,500	587.4	−7.4	0.56	36	1.11	59.5	0.770	S. 85° W.	12.6

Winter.

0	1,020.3	−1.4	.....	82	4.95	101.0	1.306	.....	.....
225	991.8	−2.8	.....	79	4.32	98.7	1.277	S. 58° W.	2.2
250	988.6	−2.9	0.40	79	4.23	98.4	1.273	S. 60° W.	2.3
500	957.9	−4.1	0.48	76	3.72	95.8	1.239	S. 55° W.	4.3
750	928.0	−4.6	0.20	72	3.36	93.0	1.203	S. 61° W.	5.9
1,000	898.9	−4.7	0.04	66	3.00	90.2	1.166	S. 71° W.	7.0
1,250	870.7	−4.8	0.04	60	2.67	87.4	1.130	S. 77° W.	8.9
1,500	843.5	−5.2	0.16	56	2.36	84.8	1.096	S. 80° W.	10.0
2,000	791.3	−6.4	0.24	50	1.85	79.9	1.033	S. 80° W.	10.3
2,500	742.2	−8.0	0.32	49	1.58	75.4	0.975	S. 84° W.	12.9
3,000	695.9	−10.3	0.46	50	1.39	71.3	0.922	S. 82° W.	13.4
3,500	652.4	−12.9	0.52	52	1.13	67.5	0.873	S. 79° W.	13.1
4,000	611.0	−15.5	0.52	50	0.88	63.9	0.826	S. 65° W.	16.9

Annual.

0	1,017.6	13.5	.....	70	11.53	95.3	1.232	.....	.....
225	990.7	11.3	.....	70	10.79	93.5	1.209	S. 53° W.	1.8
250	987.7	11.1	0.80	70	10.63	93.3	1.206	S. 54° W.	1.9
500	958.5	9.2	0.76	69	9.27	91.2	1.179	S. 53° W.	3.5
750	930.0	7.9	0.52	67	8.35	88.9	1.149	S. 60° W.	4.6
1,000	902.2	6.8	0.44	65	7.59	86.6	1.120	S. 65° W.	5.5
1,250	875.1	5.8	0.40	63	6.86	84.3	1.090	S. 72° W.	6.4
1,500	848.8	4.8	0.40	61	6.13	82.1	1.061	S. 76° W.	7.2
2,000	798.2	2.8	0.40	56	4.62	77.8	1.006	S. 78° W.	8.4
2,500	750.3	0.6	0.44	52	3.46	73.8	0.954	S. 82° W.	9.4
3,000	705.1	−1.9	0.50	50	2.64	70.0	0.905	S. 83° W.	10.7
3,500	662.2	−4.5	0.52	50	2.04	66.4	0.858	S. 82° W.	11.4
4,000	621.3	−6.9	0.48	49	1.49	62.9	0.813	S. 84° W.	11.4
4,500	582.9	−9.5	0.52	48	1.14	59.6	0.770	S. 88° W.	13.0
5,000	546.1	−12.1	0.52	40	0.80	56.4	0.729	N. 22° W.	18.8

TABLE 5a.—*Extreme values of free-air pressures, temperatures, and humidities at Broken Arrow, Okla.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Percentage frequency of temperatures.							Relative humidity.		Vapor pressure.	
	Maximum.	Minimum.	Maximum.	Minimum.	Above 30°	20° to 29.9°	10° to 19.9°	0° to 9.9°	−10° to −0.1°	−20° to −10.1°	−30° to −20.1°	Maximum.	Minimum.	Maximum.	Minimum.
m.	*mb.*	*mb.*	*°C.*	*°C.*	%	%	%	%	%	%	%	%	%	*mb.*	*mb.*
233	995.0	980.2	36.4	12.0	17	74	9	0	0	0	0	100	26	30.16	12.14
250	992.3	977.3	36.2	11.8	14	76	10	0	0	0	0	100	26	29.97	11.96
500	964.4	950.1	32.3	8.7	6	78	15	1	0	0	0	100	26	24.05	5.18
750	937.0	922.8	30.2	7.6	1	76	22	1	0	0	0	98	26	22.52	3.82
1,000	910.2	896.2	28.2	7.4	0	65	33	2	0	0	0	98	20	20.82	5.51
1,250	884.2	870.7	26.2	5.6	0	42	55	3	0	0	0	99	32	19.30	5.66
1,500	859.0	845.2	24.5	3.8	0	22	76	2	0	0	0	98	24	16.42	3.49
2,000	810.2	794.5	19.6	1.6	0	0	94	6	0	0	0	97	3	12.96	0.42
2,500	763.7	746.4	16.4	2.3	0	0	80	20	4	0	0	98	2	11.78	0.22
3,000	719.0	701.9	13.0	−0.1	0	0	41	55	4	0	0	90	1	7.60	0.09
3,500	676.0	670.0	9.3	−2.5	0	0	0	100	0	0	0	43	43	3.45	3.45
4,000	631.0	631.0	3.8	−3.8	0	0	0	100	0	0	0				

Winter.

233	1,008.6	970.8	19.9	−16.7	0	0	14	62	22	2	0	100	32	14.04	1.26
250	1,006.2	969.0	19.8	−17.0	0	0	14	63	21	2	0	100	32	13.70	1.22
500	974.7	939.0	17.9	−20.5	0	0	17	54	25	3	1	100	28	12.60	0.88
750	943.8	910.4	16.2	−21.8	0	0	17	51	26	5	1	100	18	11.76	0.78
1,000	914.3	882.5	18.8	−20.4	0	0	17	56	20	6	1	100	6	9.92	0.68
1,250	887.0	855.0	18.2	−18.2	0	0	15	52	26	7	0	100	1	7.32	0.20
1,500	861.5	836.7	16.2	−12.6	0	0	8	56	32	4	0	100	5	7.46	0.56
2,000	807.6	787.0	12.8	−12.2	0	0	4	58	27	11	0	95	2	7.45	0.22
2,500	758.9	737.8	9.6	−13.2	0	0	0	52	42	6	0	76	4	5.86	0.13
3,000	713.0	692.2	3.0	−16.0	0	0	0	19	69	12	0	78	4	2.07	0.20
3,500	669.5	654.4	−0.5	− 9.2	0	0	0	0	80	20	0	70	1	2.22	0.04
4,000	628.4	613.8	−3.9	−10.4	0	0	0	0	100	0	0	25	1	0.72	0.03

TABLE 5b.—*Extreme values of free-air pressures, temperatures, and humidities at Drexel, Nebr.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Percentage frequency of temperatures.								Relative humidity.		Vapor pressure.	
	Maximum.	Minimum.	Maximum.	Minimum.	Above 30°	20° to 29.9°	10° to 19.9°	0° to 9.9°	−10° to −0.1°	−20° to −10.1°	−30° to −20.1°	Below −30°	Maximum.	Minimum.	Maximum.	Minimum.
m.	*mb.*	*mb.*	*°C.*	*°C.*	%	%	%	%	%	%	%	%	%	%	*mb.*	*mb.*
396	980.0	956.8	37.8	10.4	7	68	25	0	0	0	0	0	98	20	27.56	5.87
500	968.5	945.4	36.5	10.4	5	67	28	0	0	0	0	0	99	24	25.36	4.60
750	940.6	918.2	33.3	7.8	1	63	35	1	0	0	0	0	100	16	23.02	2.06
1,000	913.4	892.2	34.2	6.4	1	53	44	2	0	0	0	0	98	3	20.82	0.40
1,250	886.6	867.0	33.1	5.2	(1)	43	51	6	0	0	0	0	98	16	18.82	3.44
1,500	861.2	841.9	31.0	3.8	(1)	32	59	9	0	0	0	0	96	9	15.12	1.78
2,000	809.6	791.4	26.6	0.8	0	10	72	18	0	0	0	0	100	4	13.22	0.40
2,500	764.7	744.5	22.0	− 3.7	0	1	66	32	1	0	0	0	100	1	11.48	0.09
3,000	720.5	700.8	17.4	− 7.0	0	0	37	57	6	0	0	0	93	1	8.72	0.07
3,500	678.5	658.0	12.8	−10.2	0	0	6	80	13	1	0	0	94	8	7.14	0.49
4,000	639.4	617.3	7.6	−10.3	0	0	0	70	28	2	0	0				

Winter.

396	996.2	937.6	12.8	−29.1	0	0	1	30	40	25	4	0	100	28	9.94	0.41
500	978.1	925.9	12.4	−30.2	0	0	2	29	40	25	4	(1)	100	29	9.46	0.35
750	949.5	900.1	17.7	−32.4	0	0	5	30	34	26	5	(1)	100	16	9.10	0.29
1,000	916.7	869.0	17.8	−32.6	0	0	7	29	35	24	5	(1)	100	14	9.09	0.28
1,250	885.6	842.6	16.8	−32.8	0	0	8	31	35	22	4	(1)	100	10	8.32	0.28
1,500	856.3	818.7	16.9	−31.4	0	0	7	31	38	21	3	(1)	100	7	8.08	0.32
2,000	807.8	771.2	14.6	−31.4	0	0	2	28	44	24	2	(1)	100	4	6.45	0.20
2,500	759.4	718.9	10.6	−30.6	0	0	(1)	20	52	24	4	(1)	100	1	6.02	0.03
3,000	712.4	669.3	4.6	−31.9	0	0	0	11	47	37	5	(1)	100	1	4.76	0.02
3,500	669.8	623.6	1.2	−33.4	0	0	0	3	43	44	9	1	99	1	3.76	0.02
4,000	628.5	581.5	−1.8	−34.6	0	0	0	0	33	49	15	3	100	2	2.58	0.05

[1] Less than 0.5 per cent.

TABLE 5c.—*Extreme values of free-air pressures, temperatures, and humidities at Ellendale, N. Dak.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Percentage frequency of temperatures.								Relative humidity.		Vapor pressure.	
	Maximum.	Minimum.	Maximum.	Minimum.	Above 30°	20° to 29.9°	10° to 19.9°	0° to 9.9°	−10° to −0.1°	−20° to −10.1°	−30° to −20.1°	Below −30°	Maximum.	Minimum.	Maximum.	Minimum.
m.	*mb.*	*mb.*	*°C.*	*°C.*	%	%	%	%	%	%	%	%	%	%	*mb.*	*mb.*
444	972.5	947.7	32.2	8.1	3	47	49	1	0	0	0	0	98	24	30.07	6.73
500	966.0	942.2	31.4	7.9	3	44	52	1	0	0	0	0	98	24	28.97	6.50
750	938.2	914.4	30.2	6.9	(1)	40	56	4	0	0	0	0	100	24	24.38	5.54
1,000	911.0	887.3	28.6	4.6	0	33	60	7	0	0	0	0	100	20	23.10	4.58
1,250	884.4	861.2	30.5	2.8	(1)	23	64	13	0	0	0	0	100	20	22.23	3.90
1,500	858.6	836.0	28.9	0.6	0	15	67	18	0	0	0	0	100	19	20.92	3.10
2,000	809.8	786.5	25.7	−2.6	0	4	60	34	2	0	0	0	100	14	16.14	1.54
2,500	762.3	741.7	21.1	−5.0	0	2	42	52	4	0	0	0	100	10	12.72	1.24
3,000	718.4	699.5	16.4	−6.8	0	0	18	71	11	0	0	0	100	8	9.00	0.60
3,500	674.4	656.3	11.6	−8.7	0	0	3	71	26	0	0	0	98	8	7.34	0.45
4,000	634.5	622.0	4.2	−9.4	0	0	0	42	58	0	0	0	96	10	4.93	0.55

Winter.

444	989.4	942.2	7.5	−31.3	0	0	0	16	40	28	15	1	100	45	6.33	0.28
500	982.2	935.4	7.0	−30.4	0	0	0	16	39	29	16	(1)	100	44	6.21	0.28
750	947.9	906.3	13.1	−30.1	0	0	1	15	37	30	17	(1)	100	29	6.04	0.21
1,000	915.1	878.3	12.4	−30.4	0	0	2	20	34	29	15	(1)	100	18	6.23	0.19
1,250	884.8	851.0	10.8	−30.3	0	0	2	21	39	24	13	1	100	16	6.30	0.18
1,500	857.6	825.5	10.6	−30.2	0	0	(1)	24	40	24	11	1	100	15	6.44	0.16
2,000	804.8	774.2	9.6	−29.0	0	0	0	17	44	26	13	0	100	15	6.28	0.18
2,500	755.0	724.5	6.6	−29.2	0	0	0	7	47	35	11	0	98	15	5.04	0.16
3,000	708.2	675.8	2.4	−28.4	0	0	0	2	37	48	13	0	98	6	3.84	0.15
3,500	664.0	630.5	−2.2	−30.6	0	0	0	0	27	53	16	4	93	4	2.58	0.13
4,000	621.6	588.4	−9.0	−30.8	0	0	0	0	6	64	21	9	80	3	1.69	0.07

[1] Less than 0.5 per cent.

TABLE 5d.—*Extreme values of free-air pressures, temperatures, and humidities at Groesbeck, Tex.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Percentage frequency of temperatures.						Relative humidity.		Vapor pressure.	
	Maximum.	Minimum.	Maximum.	Minimum.	Above 30°	20° to 29.9°	10° to 19.9°	0° to 9.9°	−10° to −0.1°	−20° to −10.1°	Maximum.	Minimum.	Maximum.	Minimum.
m.	*mb.*	*mb.*	*°C.*	*°C.*	%	%	%	%	%	%	%	%	*mb.*	*mb.*
141	1,004.4	993.5	32.8	12.8	7	91	2	0	0	0	96	38	31.78	13.15
250	992.1	981.2	31.1	12.2	4	94	2	0	0	0	97	43	29.88	13.07
500	964.4	953.4	30.9	10.8	1	92	7	0	0	0	99	38	29.45	10.18
750	937.4	926.3	28.3	9.6	0	84	15	1	0	0	100	34	28.33	10.27
1,000	911.0	899.9	24.0	8.4	0	60	39	1	0	0	99	20	27.02	5.74
1,250	885.2	874.3	23.1	7.2	0	35	64	1	0	0	98	19	21.36	5.07
1,500	860.7	848.7	22.4	6.2	0	13	86	1	0	0	96	18	18.32	4.49
2,000	811.0	800.0	18.3	4.8	0	0	98	2	0	0	96	18	15.65	3.54
2,500	764.3	752.2	14.8	3.1	0	0	86	14	0	0	94	18	12.97	2.58
3,000	718.8	706.0	10.8	0.6	0	0	19	81	0	0	95	20	10.61	1.91
3,500	673.6	664.3	8.3	−1.9	0	0	0	86	14	0	88	14	9.12	1.24
4,000	632.7	624.0	3.4	−4.4	0	0	0	67	33	0	60	14	4.09	1.05

Winter.

141	1,025.0	985.3	21.4	− 7.0	0	4	40	45	11	0	100	34	21.78	2.46
250	1,010.8	974.0	20.4	− 7.8	0	1	42	45	12	0	100	28	21.56	1.82
500	979.0	945.0	19.0	− 9.4	0	0	44	42	14	0	100	12	20.30	0.71
750	948.2	917.3	19.2	− 6.8	0	0	41	45	14	0	100	2	18.93	0.16
1,000	918.7	889.4	18.6	− 7.9	0	0	37	53	10	0	100	8	16.58	1.00
1,250	890.3	862.3	17.0	− 8.0	0	0	32	57	11	0	100	6	14.88	0.60
1,500	863.3	836.0	16.0	− 9.0	0	0	24	61	15	0	99	2	13.51	0.40
2,000	810.0	785.0	13.6	−11.0	0	0	19	61	19	1	100	2	10.70	0.13
2,500	761.7	741.2	11.8	−12.8	0	0	5	66	28	1	100	1	7.86	0.06
3,000	716.2	695.6	9.3	−14.6	0	0	0	53	45	2	87	1	5.68	0.05
3,500	673.0	651.0	3.8	−15.2	0	0	0	45	48	7	84	1	4.69	0.07
4,000	632.6	612.3	0.2	−13.1	0	0	0	10	70	20	56	10	2.22	0.34

TABLE 5e.—*Extreme values of free-air pressures, temperatures, and humidities at Leesburg, Ga.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Percentage frequency of temperatures.					Relative humidity.		Vapor pressure.	
	Maximum.	Minimum.	Maximum.	Minimum.	Above 30°.	20° to 29.9°.	10° to 19.9°.	0° to 9.9°.	−10° to −0.1°.	Maximum.	Minimum.	Maximum.	Minimum.
m.	*mb.*	*mb.*	°C.	°C.	%	%	%	%	%	%	%	*mb.*	*mb.*
85	1,015.4	1,000.3	35.6	22.5	18	82	0	0	0	92	28	30.28	13.88
250	996.9	981.6	34.2	20.1	6	94	0	0	0	90	28	29.24	12.54
500	969.0	954.4	32.2	18.0	2	90	8	0	0	92	27	27.82	10.81
750	941.0	927.5	30.5	16.7	2	67	31	0	0	96	28	24.84	9.46
1,000	914.0	901.0	23.6	15.2	0	30	70	0	0	94	54	21.22	9.23
1,250	887.8	875.4	21.7	12.4	0	3	97	0	0	94	54	19.24	8.10
1,500	862.0	849.8	19.8	11.0	0	0	100	0	0	93	44	16.88	6.74
2,000	812.0	800.8	16.2	9.8	0	0	96	4	0	92	20	13.99	3.45
2,500	765.0	753.9	13.1	7.0	0	0	63	37	0	92	28	12.01	4.02
3,000	721.3	713.5	9.6	6.2	0	0	0	100	0	90	31	10.01	3.34
3,500	674.1	671.9	6.6	4.0	0	0	0	100	0	80	26	6.83	2.30
4,000	635.0	632.1	4.0	3.7	0	0	0	100	0	54	29	4.27	2.31

Winter.

85	1,026.1	994.0	24.7	−2.0	0	12	54	33	1	100	26	22.21	1.32
250	1,005.8	982.0	23.0	−3.0	0	6	49	42	3	93	28	20.72	1.26
500	975.2	945.9	20.5	−4.4	0	2	53	39	6	96	24	19.14	1.08
750	942.1	918.5	18.1	−5.6	0	0	48	44	8	96	22	17.60	0.94
1,000	914.1	892.0	15.9	−6.8	0	0	42	49	9	96	16	16.28	0.80
1,250	887.0	865.0	14.2	−7.0	0	0	30	59	11	94	14	15.12	0.66
1,500	860.9	838.4	13.6	−9.0	0	0	29	61	10	86	8	12.23	0.45
2,000	810.2	787.0	12.4	−10.0	0	0	7	78	15	90	1	10.58	0.07
2,500	762.4	737.6	10.5	−9.7	0	0	3	79	18	88	10	7.61	0.60
3,000	717.4	696.0	4.8	−7.5	0	0	0	70	30	91	10	6.12	0.56
3,500	674.7	664.0	4.2	−2.4	0	0	0	55	45	92	16	5.05	0.90
4,000	634.6	625.5	1.6	−4.6	0	0	0	25	75	79	19	3.06	0.80

TABLE 5f.—*Extreme values of free-air pressures, temperatures, and humidities at Royal Center, Ind.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Percentage frequency of temperatures.							Relative humidity.		Vapor pressure.	
	Maximum.	Minimum.	Maximum.	Minimum.	Above 30°.	20° to 29.9°.	10° to 19.9°.	0° to 9.9°.	−10° to −0.1°.	−20° to −10.1°.	−30° to −20.1°.	Maximum.	Minimum.	Maximum.	Minimum.
m.	*mb.*	*mb.*	°C.	°C.	%	%	%	%	%	%	%	%	%	*mb.*	*mb.*
225	999.4	977.0	37.8	10.8	11	73	16	0	0	0	0	92	29	28.30	9.35
250	996.5	974.9	37.6	10.9	11	72	17	0	0	0	0	90	29	27.98	9.27
500	968.8	946.8	34.8	11.0	3	63	34	0	0	0	0	96	29	25.96	7.46
750	941.0	919.8	32.7	9.2	2	55	41	2	0	0	0	96	32	24.30	5.81
1,000	913.2	894.0	30.6	7.9	2	40	54	4	0	0	0	95	24	23.76	3.88
1,250	885.4	868.5	28.4	6.8	0	24	68	8	0	0	0	96	6	22.68	1.12
1,500	860.4	843.9	26.4	6.0	0	8	78	14	0	0	0	97	9	20.36	1.17
2,000	811.6	794.8	23.4	3.2	0	3	75	22	0	0	0	100	2	18.35	0.39
2,500	764.6	747.8	20.0	1.6	0	1	56	43	0	0	0	100	2	15.40	0.27
3,000	720.7	704.7	15.8	−0.9	0	0	13	85	2	0	0	100	2	10.36	0.24
3,500	679.8	663.0	9.9	−1.8	0	0	0	95	5	0	0	82	7	7.74	0.37
4,000	640.1	627.6	6.4	−1.6	0	0	0	80	20	0	0	74	17	6.34	1.17

Winter.

225	1,028.8	959.6	13.6	−20.6	0	0	3	34	50	13	(1)	97	52	15.00	0.66
250	1,024.6	956.0	13.4	−20.4	0	0	3	34	49	13	1	96	52	14.12	0.70
500	992.3	928.0	12.3	−21.2	0	0	1	28	53	16	2	98	31	13.10	0.54
750	961.5	900.6	12.1	−23.3	0	0	1	29	46	21	3	100	22	12.00	0.45
1,000	930.0	873.8	11.1	−24.4	0	0	1	29	46	22	2	100	13	10.14	0.41
1,250	886.2	847.5	9.6	−24.4	0	0	0	31	43	24	2	100	6	8.59	0.42
1,500	860.0	822.2	10.0	−24.2	0	0	2	31	39	25	3	100	4	7.89	0.41
2,000	809.0	773.0	9.4	−23.5	0	0	0	24	46	25	5	100	1	5.03	0.08
2,500	760.7	730.0	7.5	−22.6	0	0	0	15	47	33	5	96	1	4.14	0.07
3,000	714.5	684.6	1.4	−24.5	0	0	0	5	49	43	3	98	1	2.46	0.05
3,500	670.0	639.5	−1.6	−22.2	0	0	0	0	50	39	11	99	1	2.30	0.05
4,000	621.0	605.2	−7.5	−21.0	0	0	0	0	33	33	34	46	14	0.44	0.23

(1) Less than 0.5 per cent.

TABLE 6.—*Mean free-air barometric and vapor pressures, temperatures, and densities at about latitude 40° in the United States.*

Summer.

Altitude, m. s. l.	Pressure.		Temperature.		Vapor pressure.		Density.	
m.	*mb.*	*mm.*	°C.	°A.	*mb.*	*mm.*	%[1]	*kg./m.*[3]
0	1,014.0	760.5	25.0	298.0	22.0	16.5	90.9	1.175
500	957.5	718.0	22.0	295.0	17.5	13.0	86.8	1.123
1,000	904.0	678.0	19.0	292.0	14.0	10.5	82.9	1.072
1,500	852.5	639.5	16.0	289.0	11.0	8.5	79.1	1.023
2,000	803.5	602.5	13.0	286.0	8.5	6.5	75.4	0.975
2,500	757.0	568.0	10.0	283.0	6.5	5.0	71.8	.929
3,000	713.0	535.0	7.0	280.0	5.0	4.0	68.4	.885
4,000	630.5	473.0	0.5	273.5	3.5	2.5	62.0	.801
5,000	556.0	417.0	−5.5	267.5	2.0	1.5	55.9	.723
6,000	488.5	366.5	−12.5	260.5	1.0	1.0	50.5	.653
7,000	428.0	321.0	−19.5	253.5	0.5	0.5	45.4	.587
8,000	373.5	280.0	−26.0	247.0	.....	.....	40.7	.527
9,000	324.5	243.5	−32.5	240.5	.....	.....	36.4	.470
10,000	281.0	211.0	−39.0	234.0	.....	.....	32.4	.418
11,000	242.5	182.0	−45.5	227.5	.....	.....	28.7	.371
12,000	208.5	156.5	−52.0	221.0	.....	.....	25.4	.329
13,000	178.5	134.0	−55.0	218.0	.....	.....	22.1	.285
14,000	152.5	114.5	−55.0	218.0	.....	.....	18.8	.244
15,000	130.5	98.0	−55.0	218.0	.....	.....	16.1	.209
16,000	111.5	83.5	−55.0	218.0	.....	.....	13.8	.178
17,000	95.5	71.5	−55.0	218.0	.....	.....	11.8	.153
18,000	81.5	61.0	−55.0	218.0	.....	.....	10.1	.130
19,000	69.5	52.0	−55.0	218.0	.....	.....	8.6	.111
20,000	59.5	44.5	−55.0	218.0	.....	.....	7.4	.095

Winter.

0	1,020.0	765.0	−2.0	271.0	4.5	3.5	101.2	1.309
500	957.5	718.0	−3.0	270.0	3.5	2.5	95.4	1.234
1,000	899.0	674.5	−3.0	270.0	3.0	2.5	89.6	1.159
1,500	844.0	633.0	−4.0	269.0	2.5	2.0	84.4	1.092
2,000	792.0	594.0	−5.0	268.0	2.0	1.5	79.6	1.029
2,500	743.0	557.5	−7.0	266.0	2.0	1.5	75.2	0.972
3,000	697.0	523.0	−9.0	264.0	1.5	1.0	71.0	.918
4,000	611.5	458.5	−14.5	258.5	1.0	1.0	63.7	.823
5,000	535.0	401.5	−20.5	252.5	0.5	0.5	57.1	.738
6,000	466.5	350.0	−27.5	245.5	.....	.....	51.2	.662
7,000	405.5	304.0	−34.5	238.5	.....	.....	45.8	.592
8,000	350.5	263.0	−41.0	232.0	.....	.....	40.7	.526
9,000	302.0	226.5	−46.5	226.5	.....	.....	35.9	.464
10,000	259.5	194.5	−50.0	223.0	.....	.....	31.4	.405
11,000	222.5	167.0	−52.5	220.5	.....	.....	27.2	.352
12,000	190.5	143.0	−54.0	219.0	.....	.....	23.4	.303
13,000	163.0	122.5	−55.0	218.0	.....	.....	20.1	.260
14,000	139.5	104.5	−55.0	218.0	.....	.....	17.2	.223
15,000	119.0	89.5	−55.0	218.0	.....	.....	14.7	.190
16,000	102.0	76.5	−55.0	218.0	.....	.....	12.6	.163
17,000	87.0	65.5	−55.0	218.0	.....	.....	10.8	.139
18,000	74.5	56.0	−55.0	218.0	.....	.....	9.2	.119
19,000	64.0	48.0	−55.0	218.0	.....	.....	7.9	.102
20,000	54.5	41.0	−55.0	218.0	.....	.....	6.7	.087

Annual.[2]

0	1,017.0	763.0	11.5	284.5	11.5	8.5	95.9	1.240
500	957.5	718.0	9.5	282.5	9.5	7.0	91.0	1.176
1,000	901.5	676.0	8.0	281.0	7.5	5.5	86.2	1.114
1,500	848.5	636.5	6.0	279.0	6.0	4.5	81.7	1.056
2,000	798.0	598.5	4.0	277.0	5.0	4.0	77.4	1.001
2,500	750.5	563.0	1.5	274.5	4.0	3.0	73.5	0.951
3,000	705.0	529.0	−1.0	272.0	3.0	2.5	69.7	.902
4,000	621.0	466.0	−7.0	266.0	2.0	1.5	62.8	.813
5,000	546.0	409.5	−13.0	260.0	1.0	1.0	56.5	.731
6,000	478.0	358.5	−20.0	253.0	0.5	0.5	50.8	.657
7,000	417.0	313.0	−27.0	246.0	.....	.....	45.7	.591
8,000	362.0	271.5	−33.5	239.5	.....	.....	40.7	.527
9,000	313.5	235.0	−39.5	233.5	.....	.....	36.2	.468
10,000	270.5	203.0	−44.5	228.5	.....	.....	31.9	.412
11,000	232.5	174.5	−49.0	224.0	.....	.....	28.0	.362
12,000	199.5	149.5	−53.0	220.0	.....	.....	24.4	.316
13,000	171.0	128.5	−55.0	218.0	.....	.....	21.1	.273
14,000	146.0	109.5	−55.0	218.0	.....	.....	18.0	.233
15,000	125.0	94.0	−55.0	218.0	.....	.....	15.4	.200
16,000	107.0	80.5	−55.0	218.0	.....	.....	13.2	.171
17,000	91.5	68.5	−55.0	218.0	.....	.....	11.3	.146
18,000	78.0	58.5	−55.0	218.0	.....	.....	9.6	.125
19,000	67.0	50.5	−55.0	218.0	.....	.....	8.3	.107
20,000	57.0	43.0	−55.0	218.0	.....	.....	7.0	.091

[1] Standard = 1.293 kg./m.[3]

[2] The annual means also represent quite closely the average spring and autumn conditions.

TABLE 7.—*Mean free-air densities, kg./m.³, in different parts of the world.*

Altitude, m. s. l.	Summer.			Winter.			Annual.						
	United States, lat. 40° N.	North-eastern France, lat. 50° N.[1]	Central Europe, lat. 52° N.[2]	United States, lat. 40° N.	North-eastern France, lat. 50° N.[1]	Central Europe, lat. 52° N.[2]	Batavia, lat. 7° S.[3]	United States, lat. 40° N.	Canada, lat. 43° N.[3]	Europe, lat. 50° N.[3]	South-eastern England, lat. 51° N.[3]	Central Europe, lat. 52° N.[3]	Toussaint's formula.[4]
m.													
0	1.175	1.224	.....	1.309	1.289	.....	1.174	1.240	1.258	1.258	1.253	.....	1.225
1,000	1.072	1.100	1.099	1.159	1.147	1.151	1.067	1.114	1.134	1.128	1.128	1.124	1.112
2,000	0.975	0.995	0.996	1.029	1.025	1.026	0.968	1.001	1.011	1.017	1.014	1.008	1.008
3,000	.885	.898	.898	0.918	0.920	0.920	.871	0.902	0.905	0.913	0.909	0.908	0.907
4,000	.801	.808	.808	.823	.827	.827	.789	.813	.815	.819	.819	.816	.820
5,000	.723	.727	.727	.738	.743	.743	.714	.731	.733	.735	.735	.734	.735
6,000	.653	.653	.653	.662	.666	.665	.645	.657	.662	.661	.658	.658	.660
7,000	.587	.587	.588	.592	.598	.593	.581	.591	.592	.590	.589	.590	.588
8,000	.527	.527	.529	.526	.530	.530	.522	.527	.528	.528	.524	.528	.525
9,000	.470	.472	.473	.464	.469	.466	.469	.468	.470	.467	.463	.468	.467
10,000	.418	.419	.422	.405	.410	.407	.419	.412	.415	.411	.409	.413	.413
11,000	.371	.369	.371	.352	.355	.351	.374	.362	.365	.358	.355	.360	.....
12,000	.329	.319	.319	.303	.303	.302	.331	.316	.314	.307	.305	.311	.....
13,000	.285	.274	.268	.260	.259	.255	.294	.273	.268	.261	.261	.264	.....
14,000	.244	.234	.234	.223	.221	.216	.261	.233	.233	.223	.223	.226	.....
15,000	.209	.201	.199	.190	.189	.186	.225	.200	.198	.191	.191	.195	.....
16,000	.178	.172	.169	.163	.162	.157	.191	.171	.169	.162	.162	.165	.....
17,000	.153	.148	.....	.139	.138	.....	.162	.146	.144	.139	.139	.....	.....
18,000	.130	.127	.....	.119	.118	.....	.135	.125	.121	.119	.119	.....	.....
19,000	.111	.109	.....	.102	.101	.....	.113	.107	.102	.102	.102	.....	.....
20,000	.095	.093	.....	.087	.086	.....	.091	.091	.088	.087	.087	.....	.....

[1] Humphreys, W. J. Temperatures, pressures, and densities of the atmosphere at various levels in the region of northeastern France, MONTHLY WEATHER REVIEW, March, 1919, 47:159–161. (Based on observations at Trappes, Uccle, Strassburg, and Munich.)
[2] Linke, Franz. Über die Luftdichte. Beiträge zur Physik der freien Atmosphäre. VIII Band. Heft 2. 73–85. 1919. (Based on observations at Lindenberg, Strassburg, and Trappes.)
[3] Dines, W. H. The characteristics of the free atmosphere. Geophysical Memoirs, No. 13. Meteorological Office, London, 1919, M. O. 220c. p. 63.
[4] Draft of interallied agreement on law adopted for the decrease of temperature with increase of altitude, March, 1920. Issued by Ministere de la Guerre, Aeronautique Militaire, Section Technique. (Discussed by W. R. Gregg in "The Standard Atmosphere." MONTHLY WEATHER REVIEW. May, 1920, 48:272–273.)

TABLE 8.—*Mean free-air densities, kg./m.³, at various latitudes and altitudes, as computed by Franz Linke.*[1]

Altitude, m. s. l.	Latitude.																			
	North.									0°	South.									Mean.
	90°	80°	70°	60°	50°	40°	30°	20°	10°		10°	20°	30°	40°	50°	60°	70°	80°	90°	
m.																				
0	1.408	1.380	1.342	1.292	1.264	1.228	1.198	1.172	1.164	1.166	1.171	1.189	1.210	1.235	1.253	1.273	1.321	1.376	1.403	1.221
4,000	0.851	0.847	0.833	0.823	0.811	0.805	0.800	0.795	0.790	0.790	0.795	0.801	0.808	0.805	0.803	0.808	0.817	0.831	0.844	0.804
8,000	.510	.515	.519	.523	.523	.528	.524	.520	.518	.518	.519	.520	.520	.526	.522	.511	.508	.504	.502	.521
12,000	.282	.288	.292	.302	.314	.324	.334	.341	.345	.345	.341	.334	.332	.323	.314	.295	.286	.280	.278	.326
16,000	.156	.158	.161	.166	.172	.182	.190	.198	.205	.208	.204	.196	.189	.181	.173	.162	.158	.155	.153	.187

[1] Über die Luftdichte. Beiträge zur Physik der freien Atmosphäre. VIII Band. Heft 3/4. 194–199, 1919.

TABLE 9a.—*Average free-air winds at Broken Arrow, Okla.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 233		500		750		1,000		2,000		3,000		4,000		5,000	
		Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
			m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.
N	Spring	N.	7.8	N. 6° E.	7.1	N. 12° E.	6.8	N. 17° E.	6.7	N. 5° E.	11.4	N.	14.4				
	Summer	N.	5.2	N.	6.6	N. 6° E.	7.6	N. 11° E.	7.1	N.	5.1						
	Autumn	N.	8.4	N. 4° E.	9.6	N. 7° E.	10.2	N. 11° E.	9.8	N. 14° W.	10.3	N. 22° W.	12.0	N. 45° W.	19.0		
	Winter	N.	8.1	N. 3° E.	10.6	N. 2° E.	11.9	N. 4° E.	13.3	N. 20° W.	15.9	N. 38° W.	20.1				
	Annual	N.	7.4	N. 3° E.	8.5	N. 7° E.	9.1	N. 11° E.	9.2	N. 7° W.	10.7	N. 20° W.	13.6	N. 45° W.	19.8		
NNE	Spring	N. 22° E.	7.1	N. 22° E.	7.9	N. 20° E.	7.8	N. 20° E.	6.9	N. 4° W.	5.9	S. 45° W.	6.9	S. 22° W.	12.9		
	Summer	N. 22° E.	6.8	N. 34° E.	8.3	N. 37° E.	7.6	N. 54° E.	6.2	N. 22° E.	2.5						
	Autumn	N. 22° E.	6.1	N. 34° E.	8.5	N. 37° E.	9.8	N. 44° E.	9.7	N. 30° E.	8.5	N. 7° E.	6.7				
	Winter	N. 22° E.	8.0	N. 28° E.	9.4	N. 32° E.	9.9	N. 37° E.	10.0	N. 13° E.	9.4						
	Annual	N. 22° E.	7.0	N. 30° E.	8.5	N. 32° E.	8.8	N. 39° E.	8.2	N. 15° E.	6.6	N. 64° W.	6.0	S. 22° W.	10.0		
NE	Spring	N. 45° E.	7.2	N. 51° E.	7.4	N. 56° E.	7.4	N. 67° E.	7.3	N. 72° E.	4.9	S. 45° E.	5.9				
	Summer	N. 45° E.	6.3	N. 41° E.	8.0	N. 39° E.	8.9	N. 38° E.	8.9	N. 17° E.	9.0						
	Autumn	N. 45° E.	4.7	N. 49° E.	7.8	N. 49° E.	8.1	N. 47° E.	7.5	N. 39° E.	7.1	N. 22° E.	6.1	N. 22° E.			
	Winter	N. 45° E.	5.4	N. 45° E.	7.4	N. 45° E.	9.4	N. 51° E.	9.6	N. 45° W.	8.4	N. 45° W.	6.4				
	Annual	N. 45° E.	5.9	N. 46° E.	7.6	N. 49° E.	8.4	N. 51° E.	8.3	N. 23° E.	7.4	N. 22° E.	6.6	N. 22° E.			
ENE	Spring	N. 68° E.	7.0	N. 75° E.	9.7	E.	10.7	S. 75° E.	9.0	E.	3.0						
	Summer	N. 68° E.	10.5	N. 68° E.	12.5	N. 68° E.	13.5	N. 68° E.	12.5								
	Autumn	N. 68° E.	4.0	N. 68° E.	5.0	N. 68° E.	6.0	N. 68° E.	6.0								
	Winter																
	Annual	N. 68° E.	7.2	N. 70° E.	9.1	N. 75° E.	10.1	N. 80° E.	9.2	E.	3.2						
E	Spring	E.	6.2	S. 73° E.	9.7	S. 67° E.	11.5	S. 46° E.	11.7	S. 22° E.	10.3						
	Summer	E.	3.5	S. 77° E.	7.5	S. 72° E.	9.5	S. 72° E.	9.0	E.	8.0						
	Autumn	E.	4.0	S. 68° E.	4.0	S. 68° E.	4.0	E.	5.0								
	Winter																
	Annual	E.	4.6	S. 73° E.	7.1	S. 69° E.	8.3	S. 69° E.	8.6	S. 56° E.	7.9						
ESE	Spring	S. 68° E.	6.7	S. 52° E.	8.0	S. 45° E.	8.3	S. 37° E.	7.6		6.3	S. 45° W.	8.3	W.	8.3		
	Summer	S. 68° E.	3.5	S. 34° E.	7.5	S. 11° E.	9.5	S. 11° W.	9.5	S. 68° W.	8.0	W.	9.5				
	Autumn	S. 68° E.	6.0	S. 68° E.	10.0	S. 45° E.	11.0	S. 45° E.	9.0								
	Winter	S. 68° E.	4.5	S. 56° E.	10.0	S. 34° E.	11.0	S. 34° E.	10.5	S.	9.5						
	Annual	S. 68° E.	5.2	S. 53° E.	8.9	S. 34° E.	10.0	S. 27° E.	9.2	S. 34° W.	6.0	S. 68° W.	7.8	W.	7.8		
SE	Spring	S. 45° E.	7.4	S. 42° E.	9.2	S. 34° E.	10.8	S. 21° E.	10.4	S. 16° W.	9.6	S. 22° E.	11.4				
	Summer	S. 45° E.	6.0	S. 22° E.	8.7	S. 8° E.	8.9	S. 8° W.	8.0	S. 14° W.	7.5	S. 15° W.	9.6	W.	10.6		
	Autumn	S. 45° E.	6.3	S. 31° E.	9.4	S. 27° E.	10.2	S. 6° E.	10.2	S. 34° W.	10.8	S. 68° W.	10.0	W.	11.0	W.	11.0
	Winter	S. 45° E.	7.3	S. 30° E.	10.6	S. 15° E.	12.6	S. 15° E.	13.3	S.	14.0						
	Annual	S. 45° E.	6.8	S. 31° E.	9.5	S. 21° E.	10.6	S. 9° E.	10.5	S. 16° W.	10.5	S. 20° W.	12.6	W.	13.6	W.	13.6
SSE	Spring	S. 22° E.	8.3	S. 11° E.	11.6	S. 2° E.	13.4	S. 6° W.	13.6	S. 20° W.	14.3	S. 58° W.	15.5	S. 68° W.	19.5		
	Summer	S. 22° E.	6.1	S. 22° E.	7.9	S. 20° E.	8.7	S. 9° E.	8.6	S. 7° W.	6.5	S. 11° W.	7.8	S. 11° W.	9.1		
	Autumn	S. 22° E.	6.8	S. 13° E.	11.0	S. 8° E.	12.0	S.	12.1	S. 20° W.	11.7	S. 43° W.	11.6	S. 53° W.	11.2	S. 79° W.	13.7
	Winter	S. 22° E.	6.1	S. 2° W.	11.1	S. 11° W.	12.7	S. 22° W.	12.7	S. 32° W.	11.4	S. 56° W.	11.4				
	Annual	S. 22° E.	6.8	S. 11° E.	10.4	S. 5° E.	11.7	S. 5° W.	11.8	S. 20° W.	11.0	S. 42° W.	11.6	S. 44° W.	13.2	S. 79° W.	16.0
S	Spring	S.	9.4	S. 5° W.	12.6	S. 7° W.	14.3	S. 15° W.	14.7	S. 35° W.	12.8	S. 62° W.	13.3	W.	14.7		
	Summer	S.	5.4	S. 9° W.	8.4	S. 15° W.	9.4	S. 19° W.	9.2	S. 31° W.	7.8	S. 41° W.	7.0	S. 45° W.	6.5		
	Autumn	S.	7.3	S. 4° W.	10.2	S. 7° W.	11.5	S. 11° W.	11.6	S. 21° W.	10.7	S. 37° W.	10.3	S. 60° W.	12.0		
	Winter	S.	8.0	S. 6° W.	13.0	S. 14° W.	15.2	S. 26° W.	16.3	S. 38° W.	16.0	S. 68° W.	17.8	S. 68° W.	18.8		
	Annual	S.	7.8	S. 6° W.	11.0	S. 11° W.	12.6	S. 18° W.	13.0	S. 31° W.	11.8	S. 52° W.	12.1	S. 58° W.	13.0		
SSW	Spring	S. 22° W.	8.2	S. 22° W.	10.5	S. 28° W.	11.9	S. 32° W.	12.0	S. 50° W.	11.9	S. 67° W.	14.0	S. 68° W.	14.9		
	Summer	S. 22° W.	6.0	S. 29° W.	7.9	S. 31° W.	8.8	S. 36° W.	8.6	S. 39° W.	7.3	S. 36° W.	6.5	S. 11° W.	7.1		
	Autumn	S. 22° W.	7.4	S. 30° W.	10.8	S. 39° W.	12.3	S. 35° W.	12.3	S. 46° W.	12.5	S. 29° W.	12.0				
	Winter	S. 22° W.	8.1	S. 30° W.	11.8	S. 36° W.	13.3	S. 37° W.	13.4	S. 62° W.	14.2	S. 68° W.	16.5	N. 79° W.	23.5		
	Annual	S. 22° W.	7.4	S. 28° W.	10.2	S. 34° W.	11.6	S. 35° W.	11.6	S. 49° W.	11.5	S. 50° W.	12.5	S. 61° W.	15.0		
SW	Spring	S. 45° W.	6.6	S. 45° W.	8.1	S. 45° W.	8.9	S. 49° W.	9.3	S. 79° W.	10.6	N. 79° W.	14.3	W.	16.3		
	Summer	S. 45° W.	5.7	S. 45° W.	8.7	S. 47° W.	9.4	S. 47° W.	8.4	S. 31° W.	7.4	S. 30° W.	6.2				
	Autumn	S. 45° W.	5.1	S. 55° W.	9.5	S. 67° W.	11.1	S. 73° W.	11.5	S. 77° W.	12.4	S. 87° W.	14.6	S. 77° W.	17.4	W.	21.4
	Winter	S. 45° W.	5.8	S. 59° W.	9.2	S. 65° W.	10.8	S. 75° W.	11.2	N. 74° W.	12.5	N. 67° W.	14.0	N. 68° W.	14.0	N. 68° W.	18.0
	Annual	S. 45° W.	5.8	S. 51° W.	8.9	S. 56° W.	10.0	S. 61° W.	10.1	S. 74° W.	10.7	S. 84° W.	12.3	N. 87° W.	14.2	N. 79° W.	18.2
WSW	Spring	S. 68° W.	6.0	S. 68° W.	7.0	S. 52° W.	7.3	S. 56° W.	8.3	S. 56° W.	14.3						
	Summer	S. 68° W.	4.5	S. 79° W.	7.5	W.	9.0	N. 45° W.	10.0	N. 22° W.	10.0	N. 22° W.	60				
	Autumn	S. 68° W.	9.0	S. 68° W.	12.0	S. 68° W.	13.0	W.	14.0	W.	12.0						
	Winter	S. 68° W.	7.0	S. 73° W.	9.7	S. 79° W.	9.9	S. 75° W.	9.9	S. 68° W.	9.2						
	Annual	S. 68° W.	6.6	S. 72° W.	9.0	S. 72° W.	9.8	S. 88° W.	10.6	W.	11.4	N. 22° W.	9.4				
W	Spring	W.	6.0	S. 84° W.	7.0	S. 84° W.	7.5	S. 84° W.	8.7	N. 83° W.	12.3	W.	12.5				
	Summer	W.	6.0	W.	8.0	W.	9.5	W.	11.5	S. 79° W.	13.5						
	Autumn	W.	7.2	W.	9.8	W.	11.0	W.	13.4	W.	18.7	N. 68° W.	20.7				
	Winter	W.	5.7	W.	8.7	N. 83° W.	10.7	N. 83° W.	11.7	N. 79° W.	14.4	W.	13.4				
	Annual	W.	6.2	S. 89° W.	8.4	W.	9.7	W.	11.3	N. 88° W.	14.7	N. 83° W.	14.8				
WNW	Spring	N. 68° W.	7.5	N. 68° W.	11.0	N. 68° W.	12.8	N. 67° W.	13.6	N. 72° W.	15.0	N. 34° W.	17.3				
	Summer	[1] N. 68° W.	6.0	N. 56° W.	19.0	N. 45° W.	24.0	N. 45° W.	25.0	N. 45° W.	26.0	N. 68° W.					
	Autumn	N. 68° W.	6.0	N. 56° W.	8.0	N. 56° W.	8.0	N. 45° W.	7.0								
	Winter	N. 68° W.	7.5	N. 56° W.	11.0	N. 56° W.	14.5	N. 39° W.	16.0	N. 34° W.	19.0	N. 45° W.	22.0				
	Annual	N. 68° W.	6.8	N. 59° W.	12.2	N. 56° W.	14.8	N. 49° W.	15.4	N. 50° W.	17.1	N. 49° W.	19.7				
NW	Spring	N. 45° W.	7.5	N. 45° W.	9.3	N. 45° W.	10.5	N. 56° W.	10.5	N. 38° W.	9.7	N. 22° W.					
	Summer																
	Autumn	N. 45° W.	8.3	N. 41° W.	9.8	N. 41° W.	10.3	N. 33° W.	11.5	N. 44° W.	15.3	N. 51° W.	17.1				
	Winter	N. 45° W.	8.7	N. 45° W.	11.2	N. 43° W.	13.0	N. 43° W.	14.6	N. 45° W.	17.3	N. 56° W.	22.0	N. 68° W.	23.5		
	Annual	N. 45° W.	8.2	N. 44° W.	10.2	N. 43° W.	11.3	N. 44° W.	12.2	N. 42° W.	14.1	N. 43° W.	17.4	N. 68° W.	18.9		
NNW	Spring	N. 22° W.	11.0	N. 27° W.	11.9	N. 25° W.	12.8	N. 25° W.	12.9	N. 42° W.	14.7	N. 39° W.	16.5	N. 45° W.	19.0		
	Summer	N. 22° W.	7.7	N. 17° W.	8.7	N. 17° W.	9.0	N. 17° W.	9.0	N. 68° W.	9.0						
	Autumn	N. 22° W.	6.4	N. 19° W.	8.5	N. 19° W.	9.4	N. 22° W.	10.2	N. 44° W.	13.8						
	Winter	N. 22° W.	7.6	N. 25° W.	9.0	N. 25° W.	9.6	N. 22° W.	10.3	N. 45° W.	13.3	N. 45° W.	13.3				
	Annual	N. 22° W.	8.2	N. 22° W.	9.5	N. 22° W.	10.2	N. 22° W.	10.6	N. 50° W.	12.7	N. 42° W.	12.9	N. 45° W.	14.1		
Means	Spring	S. 9° E.	8.2	S.	10.3	S. 6° W.	11.4	S. 16° W.	11.5	S. 53° W.	11.3	S. 74° W.	12.9	S. 81° W.	15.0		
	Summer	S. 2° E.	6.1	S. 8° W.	8.3	S. 13° W.	9.2	S. 21° W.	8.9	S. 34° W.	7.7	S. 36° W.	7.5	S. 28° W.	8.2		
	Autumn	S. 3° E.	6.9	S. 4° W.	9.8	S. 12° W.	10.9	S. 17° W.	11.0	S. 44° W.	11.1	S. 59° W.	11.1	S. 72° W.	12.5	S. 84° W.	15.2
	Winter	S. 50° W.	7.4	S. 67° W.	10.8	S. 74° W.	12.4	S. 77° W.	13.1	N. 86° W.	13.9	N. 74° W.	16.2	N. 70° W.	18.8	N. 67° W.	23.8
	Annual	S. 8° W.	7.2	S. 18° W.	9.8	S. 25° W.	11.0	S. 32° W.	11.1	S. 56° W.	11.0	S. 69° W.	11.9	S. 71° W.	13.6	N. 81° W.	17.0

[1] One observation only.

TABLE 9b.—*Average free-air winds at Drexel, Nebr.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 395		500		750		1,000		2,000		3,000		4,000		5,000	
		Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
			m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.
N.	Spring	N.	5.4	N. 1° E.	7.6	N.	11.8	N. 1° W.	13.1	N. 9° W.	13.4	N. 31° W.	15.5	N. 40° W.	15.6		
	Summer	N.	3.9	N. 1° W.	6.4	N. 1° W.	10.7	N. 4° W.	11.0	N. 17° W.	11.2	N. 37° W.	12.6	N. 58° W.	16.0	N. 45° W.	22.1
	Autumn	N.	4.6	N.	6.9	N. 1° E.	11.0	N. 1° W.	12.4	N. 14° W.	13.0	N. 36° W.	15.1	N. 52° W.	18.1	N. 68° W.	20.8
	Winter	N.	5.3	N. 1° W.	7.3	N. 3° W.	11.1	N. 3° W.	11.2	N. 21° W.	11.4	N. 41° W.	13.2	N. 40° W.	15.3		
	Annual	N.	4.8	N.	7.0	N. 1° W.	11.2	N. 2° W.	11.9	N. 15° W.	12.2	N. 36° W.	14.1	N. 47° W.	16.2	N. 56° W.	20.1
NNE.	Spring	N. 22° E.	5.8	N. 22° E.	7.5	N. 20° E.	11.2	N. 22° E.	12.2	N. 8° E.	11.2	N. 14° W.	13.4	N. 41° W.	16.8	N. 45° W.	20.3
	Summer	N. 22° E.	4.0	N. 20° E.	5.9	N. 17° E.	8.9	N. 12° E.	9.0	N. 13° W.	8.5	N. 40° W.	7.5	W.	8.1		
	Autumn	N. 22° E.	4.4	N. 24° E.	6.4	N. 28° E.	9.2	N. 31° E.	8.9	N. 10° E.	6.9	N. 40° W.	8.9	N. 60° W.	8.2	N. 45° W.	9.3
	Winter	N. 22° E.	5.3	N. 25° E.	6.7	N. 28° E.	9.6	N. 31° E.	9.9	N. 40° E.	8.9	N. 13° W.	10.5				
	Annual	N. 22° E.	4.9	N. 23° E.	6.6	N. 23° E.	9.7	N. 24° E.	10.0	N. 11° E.	8.9	N. 27° W.	10.1	N. 64° W.	11.6	N. 45° W.	14.0
NE.	Spring	N. 45° E.	5.5	N. 46° E.	6.7	N. 46° E.	8.9	N. 48° E.	9.6	N. 46° E.	8.0	N. 43° E.	7.8	N. 53° E.	8.1		
	Summer	N. 45° E.	4.2	N. 46° E.	6.3	N. 46° E.	9.0	N. 48° E.	8.4	N. 30° E.	7.5	N. 68° W.	9.8	N. 53° W.	12.1		
	Autumn	N. 45° E.	4.3	N. 45° E.	6.4	N. 44° E.	9.3	N. 48° E.	10.4	N. 34° E.	9.1	N. 36° W.	11.9	N. 22° E.	10.6		
	Winter	N. 45° E.	5.6	N. 45° E.	6.6	N. 50° E.	8.3	N. 57° E.	8.9	N. 77° E.	7.4	N. 22° W.	8.6				
	Annual	N. 45° E.	4.9	N. 46° E.	6.5	N. 46° E.	8.9	N. 50° E.	9.3	N. 46° E.	8.0	N. 23° W.	9.5	N. 10° E.	10.0		
ENE.	Spring	N. 68° E.	6.4	N. 68° E.	7.6	N. 72° E.	9.9	N. 79° E.	9.7	S. 86° E.	5.2	S. 47° E.	4.0	E.	3.9		
	Summer	N. 68° E.	4.6	N. 70° E.	6.2	N. 66° E.	8.6	N. 70° E.	8.6	N. 57° E.	7.3	N. 47° W.	8.9	S. 56° W.	7.1		
	Autumn	N. 68° E.	3.9	N. 68° E.	6.1	N. 68° E.	10.0	N. 73° E.	8.9	N. 57° E.	6.3	S. 56° E.	7.3				
	Winter	N. 68° E.	5.7	N. 70° E.	6.8	N. 87° E.	8.9	S. 78° E.	9.8	S. 9° E.	9.9	S. 24° W.	13.5				
	Annual	N. 68° E.	5.2	N. 69° E.	6.7	N. 73° E.	9.4	N. 81° E.	9.2	N. 89° E.	7.2	S. 16° E.	8.4	S. 17° E.	7.6		
E.	Spring	E.	8.2	S. 87° E.	10.0	S. 86° E.	13.1	S. 81° E.	13.4	S. 75° E.	10.5	S. 36° E.	10.2	S. 68° W.	11.8	W.	16.7
	Summer	E.	4.1	S. 85° E.	6.0	S. 77° E.	8.4	S. 76° E.	7.5	S. 23° E.	7.1	S. 22° W.	9.2	S. 45° W.	10.5		
	Autumn	E.	4.8	S. 83° E.	6.5	S. 74° E.	8.8	S. 69° E.	8.8	S. 41° E.	7.7	S. 47° E.	8.2				
	Winter	E.	5.3	S. 85° E.	8.0	S. 70° E.	11.4	S. 55° E.	12.3	S. 34° E.	11.5	S. 6° E.	11.9	S. 22° W.	13.0		
	Annual	E.	5.6	S. 85° E.	7.6	S. 77° E.	10.4	S. 70° E.	10.5	S. 43° E.	9.2	S. 19° E.	9.9	S. 45° W.	11.2	W.	16.5
ESE.	Spring	S. 68° E.	6.8	S. 65° E.	9.1	S. 57° E.	11.9	S. 52° E.	12.0	S. 30° E.	11.3	S. 9° E.	11.5	S.	13.3		
	Summer	S. 68° E.	5.3	S. 67° E.	6.9	S. 58° E.	9.3	S. 50° E.	8.9	S. 7° W.	8.2	S. 53° W.	8.9				
	Autumn	S. 68° E.	4.5	S. 65° E.	6.2	S. 47° E.	9.7	S. 40° E.	10.4	S.	9.3	S. 14° W.	11.3	S. 45° W.	14.6	S. 45° W.	18.9
	Winter	S. 68° E.	5.3	S. 62° E.	7.5	S. 47° E.	10.0	S. 31° E.	10.1	S. 15° W.	9.3	S. 39° W.	8.4	S. 52° W.	10.9		
	Annual	S. 68° E.	5.5	S. 65° E.	7.7	S. 52° E.	10.2	S. 43° E.	10.4	S. 2° E.	9.5	S. 24° W.	10.0	S. 33° W.	12.4	S. 45° W.	16.4
SE.	Spring	S. 45° E.	6.9	S. 43° E.	8.7	S. 36° E.	12.0	S. 30° E.	12.6	S. 8° E.	12.2	S. 17° W.	14.2	S. 40° W.	16.1		
	Summer	S. 45° E.	4.5	S. 41° E.	6.5	S. 35° E.	9.3	S. 25° E.	9.5	S. 6° W.	7.7	S. 52° W.	7.2	S. 85° W.	8.1		
	Autumn	S. 45° E.	5.0	S. 37° E.	7.9	S. 21° E.	11.2	S. 12° E.	12.1	S. 13° W.	12.6	S. 22° W.	12.2	W.	13.0		
	Winter	S. 45° E.	5.9	S. 37° E.	8.0	S. 16° E.	11.6	S. 1° W.	12.8	S. 41° W.	14.8	S. 61° W.	16.8	S. 75° W.	21.9	W.	27.3
	Annual	S. 45° E.	5.6	S. 40° E.	7.8	S. 27° E.	11.0	S. 17° E.	11.8	S. 13° W.	11.8	S. 38° W.	12.6	S. 75° W.	14.8	W.	19.4
SSE.	Spring	S. 22° E.	6.0	S. 21° E.	8.0	S. 16° E.	11.1	S. 11° E.	11.3	S. 10° W.	10.8	S. 39° W.	10.2	S. 45° W.	11.4	S. 45° W.	13.4
	Summer	S. 22° E.	4.4	S. 19° E.	6.8	S. 11° E.	10.0	S. 4° E.	9.8	S. 19° W.	8.5	S. 36° W.	8.2	S. 40° W.	8.5	S. 58° W.	11.7
	Autumn	S. 22° E.	4.5	S. 19° E.	6.9	S. 8° E.	11.2	S.	12.0	S. 13° W.	12.0	S. 34° W.	11.7	S. 40° W.	12.3	S. 45° W.	12.7
	Winter	S. 22° E.	5.3	S. 17° E.	8.1	S.	12.2	S. 13° W.	13.4	S. 52° W.	14.7	S. 74° W.	17.7	S. 86° W.	21.3		
	Annual	S. 22° E.	5.0	S. 19° E.	7.7	S. 9° E.	11.1	S. 1° E.	11.6	S. 23° W.	11.5	S. 45° W.	12.0	S. 52° W.	13.4	S. 49° W.	15.2
S.	Spring	S.	7.2	S. 1° W.	9.9	S. 8° W.	14.0	S. 15° W.	14.4	S. 34° W.	14.1	S. 62° W.	15.6	S. 45° W.	19.1		
	Summer	S.	5.2	S. 1° W.	7.2	S. 7° W.	10.7	S. 13° W.	11.4	S. 32° W.	10.6	S. 45° W.	9.1	S. 37° W.	8.4		
	Autumn	S.	6.3	S. 1° W.	9.1	S. 9° W.	13.6	S. 14° W.	14.8	S. 31° W.	14.1	S. 41° W.	14.2	S. 47° W.	14.9	N. 78° W.	18.9
	Winter	S.	6.0	S. 3° W.	8.4	S. 15° W.	12.5	S. 26° W.	13.8	S. 50° W.	15.3	S. 66° W.	17.2	N. 84° W.	21.2		
	Annual	S.	6.2	S. 1° W.	8.6	S. 10° W.	12.7	S. 17° W.	13.6	S. 37° W.	13.5	S. 54° W.	14.0	S. 56° W.	15.9	N. 78° W.	19.8
SSW.	Spring	S. 22° W.	8.5	S. 22° W.	9.8	S. 26° W.	12.9	S. 32° W.	14.2	S. 48° W.	15.2	S. 64° W.	16.7	S. 72° W.	19.0	S. 79° W.	22.2
	Summer	S. 22° W.	6.1	S. 23° W.	8.3	S. 26° W.	12.0	S. 31° W.	12.7	S. 36° W.	12.2	S. 41° W.	12.0	S. 42° W.	11.3	S. 22° W.	9.9
	Autumn	S. 22° W.	6.9	S. 23° W.	9.5	S. 31° W.	14.1	S. 36° W.	14.6	S. 55° W.	13.2	S. 71° W.	14.6	S. 82° W.	16.0	N. 79° W.	18.1
	Winter	S. 22° W.	6.6	S. 29° W.	8.8	S. 43° W.	12.2	S. 55° W.	12.7	S. 78° W.	13.3	N. 83° W.	16.2	N. 54° W.	19.7	N. 45° W.	21.2
	Annual	S. 22° W.	7.0	S. 24° W.	9.1	S. 31° W.	12.8	S. 38° W.	13.6	S. 54° W.	13.5	S. 68° W.	14.9	S. 80° W.	16.5	S. 86° W.	17.8
SW.	Spring	S. 45° W.	7.9	S. 51° W.	9.4	S. 52° W.	12.3	S. 55° W.	13.4	S. 70° W.	14.7	S. 81° W.	15.5	N. 88° W.	17.7	W.	19.9
	Summer	S. 45° W.	6.2	S. 45° W.	8.5	S. 47° W.	12.0	S. 49° W.	12.4	S. 56° W.	11.4	S. 68° W.	11.2	N. 84° W.	11.4		
	Autumn	S. 45° W.	6.0	S. 47° W.	7.8	S. 56° W.	11.1	S. 61° W.	12.1	S. 80° W.	13.0	N. 87° W.	15.1	N. 87° W.	17.3		
	Winter	S. 45° W.	6.8	S. 50° W.	9.3	S. 65° W.	13.0	S. 73° W.	13.7	N. 87° W.	16.5	W.	19.3	W.	22.4	N. 68° W.	24.1
	Annual	S. 45° W.	6.7	S. 48° W.	8.8	S. 55° W.	12.1	S. 59° W.	12.9	S. 75° W.	13.9	S. 82° W.	15.3	N. 87° W.	17.2	N. 79° W.	19.0
WSW.	Spring	S. 68° W.	6.4	S. 74° W.	8.2	S. 88° W.	10.6	N. 88° W.	11.0	N. 85° W.	12.9	N. 84° W.	16.2	N. 83° W.	18.3		
	Summer	S. 68° W.	5.4	S. 69° W.	7.3	S. 74° W.	10.8	S. 81° W.	11.5	S. 81° W.	11.7	S. 74° W.	12.9	S. 34° W.	13.5		
	Autumn	S. 68° W.	5.2	S. 71° W.	7.4	S. 75° W.	10.1	S. 83° W.	10.0	W.	11.3	N. 82° W.	13.4	N. 71° W.	13.1	N. 68° W.	14.4
	Winter	S. 68° W.	5.5	S. 75° W.	7.9	S. 86° W.	11.9	N. 88° W.	12.7	N. 71° W.	16.3	N. 70° W.	19.0	N. 85° W.	23.8	N. 79° W.	24.1
	Annual	S. 68° W.	5.6	S. 72° W.	7.7	S. 82° W.	10.8	S. 87° W.	11.3	N. 86° W.	13.0	N. 85° W.	15.4	S. 85° W.	17.2	N. 74° W.	18.1
W.	Spring	W.	6.2	N. 87° W.	8.2	N. 84° W.	10.9	N. 82° W.	12.1	N. 74° W.	14.3	N. 81° W.	17.5	N. 76° W.	19.8	N. 45° W.	20.2
	Summer	W.	5.2		7.0	N. 82° W.	9.6	N. 74° W.	10.0	N. 75° W.	13.1	N. 72° W.	17.4	N. 69° W.	18.4	N. 45° W.	21.8
	Autumn	W.	5.6	N. 88° W.	7.2	N. 79° W.	9.5	N. 70° W.	9.6	N. 81° W.	11.4	S. 87° W.	15.8	N. 68° W.	18.4		
	Winter	W.	5.0	N. 86° W.	7.6	N. 74° W.	11.8	N. 67° W.	13.3	N. 63° W.	16.7	N. 62° W.	19.5	N. 75° W.	23.0		
	Annual	W.	5.5	N. 88° W.	7.5	N. 80° W.	10.4	N. 73° W.	11.2	N. 73° W.	13.9	N. 77° W.	17.6	N. 72° W.	19.9	N. 45° W.	22.6
WNW.	Spring	N. 68° W.	8.4	N. 69° W.	9.6	N. 70° W.	11.8	N. 65° W.	12.3	N. 74° W.	17.3	N. 75° W.	21.1	N. 72° W.	25.3	W.	27.8
	Summer	N. 68° W.	4.9	N. 66° W.	6.8	N. 60° W.	10.7	N. 64° W.	12.0	N. 63° W.	13.7	N. 68° W.	14.9	N. 51° W.	15.6	N. 56° W.	19.0
	Autumn	N. 68° W.	5.7	N. 64° W.	8.1	N. 56° W.	11.8	N. 51° W.	13.0	N. 56° W.	15.9	N. 76° W.	20.4	N. 77° W.	23.0	S. 79° W.	25.1
	Winter	N. 68° W.	5.3	N. 65° W.	7.7	N. 56° W.	12.5	N. 55° W.	14.1	N. 59° W.	17.3	N. 65° W.	20.5	N. 82° W.	23.3	W.	30.0
	Annual	N. 68° W.	6.1	N. 66° W.	8.0	N. 60° W.	11.7	N. 59° W.	12.8	N. 63° W.	16.0	N. 71° W.	19.2	N. 71° W.	21.8	N. 84° W.	25.5
NW.	Spring	N. 45° W.	6.2	N. 44° W.	8.2	N. 42° W.	11.4	N. 43° W.	12.6	N. 55° W.	15.9	N. 68° W.	19.7	N. 73° W.	25.8		
	Summer	N. 45° W.	5.4	N. 45° W.	7.8	N. 48° W.	11.7	N. 46° W.	13.1	N. 52° W.	15.6	N. 58° W.	18.4	N. 79° W.	19.5	N. 45° W.	18.2
	Autumn	N. 45° W.	5.1	N. 44° W.	7.3	N. 41° W.	11.0	N. 40° W.	12.4	N. 46° W.	16.1	N. 52° W.	18.1	N. 60° W.	20.6	N. 68° W.	22.8
	Winter	N. 45° W.	5.9	N. 43° W.	8.4	N. 40° W.	12.9	N. 38° W.	14.9	N. 44° W.	18.4	N. 54° W.	21.1	N. 71° W.	23.3		
	Annual	N. 45° W.	5.6	N. 44° W.	7.9	N. 43° W.	11.8	N. 42° W.	13.2	N. 50° W.	16.5	N. 58° W.	19.3	N. 73° W.	22.3	N. 57° W.	25.2
NNW.	Spring	N. 22° W.	6.1	N. 22° W.	8.1	N. 24° W.	12.1	N. 26° W.	13.2	N. 37° W.	14.6	N. 50° W.	17.6	N. 58° W.	19.9	S. 79° W.	24.2
	Summer	N. 22° W.	4.4	N. 22° W.	6.1	N. 24° W.	9.6	N. 25° W.	10.4	N. 32° W.	12.1	N. 45° W.	14.1	N. 54° W.	16.5	W.	19.6
	Autumn	N. 22° W.	5.7	N. 22° W.	8.1	N. 26° W.	13.0	N. 27° W.	14.8	N. 35° W.	17.1	N. 47° W.	19.1	N. 62° W.	21.5	N. 62° W.	22.2
	Winter	N. 22° W.	6.3	N. 22° W.	8.3	N. 21° W.	12.4	N. 23° W.	14.2	N. 38° W.	17.4	N. 55° W.	20.7	N. 84° W.	24.3	S. 79° W.	24.2
	Annual	N. 22° W.	5.6	N. 22° W.	7.6	N. 24° W.	11.8	N. 26° W.	13.2	N. 36° W.	15.3	N. 49° W.	17.9	N. 64° W.	20.6	N. 89° W.	22.6
Means.	Spring	S. 68° E.	6.6	S. 60° E.	8.5	S. 81° W.	11.8	S. 70° W.	12.6	S. 79° W.	13.0	S. 84° W.	14.7	N. 87° W.	17.1	W.	19.8
	Summer	S. 9° E.	5.0	S. 5° E.	7.1	S. 8° W.	10.4	S. 22° W.	10.7	S. 60° W.	10.4	S. 76° W.	11.0	S. 76° W.	11.6	N. 86° W.	13.5
	Autumn	S. 54° W.	5.5	S. 56° W.	7.9	S. 69° W.	11.8	S. 73° W.	12.7	S. 84° W.	13.2	S. 88° W.	14.6	N. 87° W.	16.2	N. 78° W.	18.3
	Winter	N. 68° W.	5.8	N. 67° W.	8.0	N. 66° W.	11.8	N. 67° W.	12.9	N. 72° W.	14.9	N. 76° W.	17.5	N. 81° W.	20.8	N. 76° W.	23.4
	Annual	S. 22° W.	5.7	S. 26° W.	7.9	S. 70° W.	11.4	S. 70° W.	12.2	S. 83° W.	12.9	S. 88° W.	14.4	N. 89° W.	16.4	N. 82° W.	18.7

TABLE 9c.—*Average free-air winds at Ellendale, N. Dak.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 444		500		750		1,000		2,000		3,000		4,000		5,000	
		Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
			m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.
N	Spring	N.	9.8	N. 1° E.	10.1	N. 4° E.	11.2	N. 11° E.	11.3	N.	12.0	N. 17° W.	13.7	N. 32° W.	16.4	N. 22° E.	17.5
	Summer	N.	6.7	N. 1° E.	7.3	N. 8° E.	10.0	N. 7° E.	10.3	N. 1° W.	9.9	N. 26° W.	10.9	N. 45° W.	13.1	N. 68° W.	17.2
	Autumn	N.	6.9	N. 3° E.	7.2	N. 15° E.	8.7	N. 22° E.	8.8	N. 2° W.	6.7	N. 39° W.	9.9	N.	11.0	.....	.....
	Winter	N.	8.4	N. 4° E.	8.7	N. 14° E.	9.9	N. 20° E.	9.6	N. 2° W.	8.6	N. 40° W.	10.2	N. 56° W.	11.7	.....	.....
	Annual	N.	8.0	N. 2° E.	8.3	N. 10° E.	10.0	N. 15° E.	10.0	N. 1° W.	9.3	N. 31° W.	11.2	N. 34° W.	13.0	N. 23° W.	15.6
NNE	Spring	N. 22° E.	8.1	N. 22° E.	8.4	N. 31° E.	9.7	N. 34° E.	9.7	N. 27° E.	7.3	N. 22° E.	7.4	W.	8.2	.....	.....
	Summer	N. 22° E.	6.5	N. 23° E.	7.1	N. 30° E.	9.3	N. 34° E.	8.9	N. 10° E.	7.2	N. 20° E.	5.9	N. 22° W.	6.5	.....	.....
	Autumn	N. 22° E.	6.2	N. 22° E.	6.6	N. 36° E.	8.2	N. 37° E.	7.8	N. 56° E.	5.5	N. 18° E.	6.0	N. 11° E.	6.2	.....	.....
	Winter	N. 22° E.	6.8	N. 22° E.	7.0	N. 37° E.	7.7	N. 43° E.	7.8	N. 36° W.	10.2	N. 49° W.	13.3	.....	.....	.....	.....
	Annual	N. 22° E.	6.9	N. 22° E.	7.3	N. 33° E.	8.7	N. 37° E.	8.5	N. 15° E.	7.6	N. 4° E.	8.2	N. 32° W.	8.7	.....	.....
NE	Spring	N°45° E.	7.9	N. 45° E.	8.1	N. 50° E.	9.1	N. 47° E.	8.8	N. 47° E.	6.4	N. 45° W.	10.7	N. 45° W.	15.5	.....	.....
	Summer	N. 45° E.	5.3	N. 48° E.	6.0	N. 55° E.	8.1	N. 58° E.	7.6	N. 87° E.	5.9	N. 67° E.	5.6	N. 45° E.	5.4	.....	.....
	Autumn	N. 45° E.	5.6	N. 48° E.	6.4	N. 60° E.	9.1	N. 69° E.	9.3	N. 70° E.	6.3	(1)	6.9	.....	.....	.....	.....
	Winter	N. 45° E.	7.5	N. 45° E.	7.9	N. 71° E.	9.5	N. 78° E.	9.6	N. 87° E.	5.8	N. 45° E.	4.4	.....	.....	.....	.....
	Annual	N. 45° E.	6.6	N. 46° E.	7.1	N. 50° E.	9.0	N. 63° E.	8.8	N. 73° E.	6.1	N. 42° E.	6.9	N.	8.8	.....	.....
ENE	Spring	N. 68° E.	8.6	N. 69° E.	9.2	N. 78° E.	11.0	S. 87° E.	11.4	S. 81° E.	11.7	S. 78° E.	11.3	E.	10.6	.....	.....
	Summer	N. 68° E.	5.4	N. 69° E.	5.8	N. 79° E.	7.2	E.	6.7	S. 43° E.	2.3	.....	.....	.....	.....	.....	.....
	Autumn	N. 68° E.	6.0	N. 74° E.	6.6	N. 87° E.	9.3	S. 83° E.	9.0	S. 58° E.	7.5	S. 22° E.	8.3	S. 45° W.	7.1	.....	.....
	Winter	N. 68° E.	5.8	N. 68° E.	6.0	N. 89° E.	6.7	S. 85° E.	6.7	S. 56° E.	3.8	.....	.....	.....	.....	.....	.....
	Annual	N. 68° E.	6.4	N. 70° E.	6.9	N. 83° E.	8.6	S. 86° E.	8.4	S. 59° E.	6.3	S. 50° E.	5.7	S. 22° E.	4.8	.....	.....
E	Spring	E.	7.9	E.	7.9	S. 85° E.	8.0	S. 72° E.	7.5	S. 52° E.	6.3	S. 34° W.	7.6	.....	.....	.....	.....
	Summer	E.	4.6	E.	5.1	S. 77° E.	6.7	S. 72° E.	7.1	S. 54° E.	4.2	S. 45° W.	3.1	S. 68° W.	0.5	.....	.....
	Autumn	E.	4.9	S. 79° E.	5.7	S. 59° E.	9.1	S. 51° E.	11.0	S. 10° E.	12.0	S. 37° W.	12.4	S. 22° E.	12.8	.....	.....
	Winter	E.	6.7	S. 79° E.	7.9	S. 62° E.	11.5	S. 56° E.	12.2	S. 38° E.	9.3	S.	7.3	.....	.....	.....	.....
	Annual	E.	6.0	S. 85° E.	6.6	S. 71° E.	8.8	S. 63° E.	9.4	S. 39° E.	8.0	S. 29° W.	7.6	S. 23° W.	6.5	.....	.....
ESE	Spring	S. 68° E.	7.5	S. 68° E.	7.9	S. 48° E.	9.8	S. 37° E.	10.5	S. 5° E.	10.5	S. 68° W.	12.6	.....	.....	.....	.....
	Summer	S. 68° E.	5.9	S. 65° E.	6.5	S. 58° E.	8.8	S. 54° E.	9.9	S. 41° E.	8.5	S. 6° E.	5.4	.....	.....	.....	.....
	Autumn	S. 68° E.	5.1	S. 62° E.	5.7	S. 53° E.	7.7	S. 38° E.	8.5	S.	8.1	S. 34° W.	8.3	S. 34° W.	9.7	S.	6.9
	Winter	S. 68° E.	5.3	S. 63° E.	5.8	S. 50° E.	7.8	S. 13° E.	8.3	S. 41° W.	12.0	S. 83° W.	14.6	N. 79° W.	20.5	W.	22.8
	Annual	S. 68° E.	6.0	S. 64° E.	6.5	S. 52° E.	8.5	S. 36° E.	9.3	S. 1° E.	9.8	S. 46° W.	10.5	S. 68° W.	12.4	S. 45° W.	12.2
SE	Spring	S. 45° E.	8.0	S. 45° E.	8.8	S. 35° E.	11.0	S. 34° E.	12.0	S. 12° E.	13.9	S. 15° W.	16.7	S. 68° W.	16.4	.....	.....
	Summer	S. 45° E.	6.8	S. 45° E.	7.4	S. 42° E.	9.9	S. 36° E.	10.7	S. 13° E.	9.2	S. 12° W.	9.6	S. 35° W.	9.7	S. 68° W.	11.3
	Autumn	S. 45° E.	6.4	S. 41° E.	7.0	S. 28° E.	9.9	S. 12° E.	10.7	S. 20° W.	10.0	S. 35° W.	10.6	W.	12.2	.....	.....
	Winter	S. 45° E.	5.4	S. 36° E.	6.4	S. 11° E.	9.4	S. 6° E.	9.9	S. 57° W.	14.7	S. 70° W.	15.8	.....	.....	.....	.....
	Annual	S. 45° E.	6.6	S. 42° E.	7.4	S. 29° E.	10.0	S. 22° E.	10.8	S. 12° W.	12.0	S. 33° W.	13.2	S. 64° W.	13.6	S. 68° W.	15.2
SSE	Spring	S. 22° E.	7.9	S. 22° E.	8.5	S. 15° E.	11.0	S. 13° E.	12.4	S. 5° E.	12.3	S. 3° W.	10.2	S. 22° W.	13.7	.....	.....
	Summer	S. 22° E.	7.4	S. 22° E.	8.0	S. 13° E.	10.7	S. 10° E.	11.6	S. 15° W.	10.4	S. 42° W.	9.0	S. 44° W.	10.5	S. 68° W.	13.3
	Autumn	S. 22° E.	7.9	S. 24° E.	9.3	S. 9° E.	14.4	S.	16.1	S. 30° W.	13.8	S. 55° W.	14.2	S. 45° W.	19.1	S. 68° W.	21.2
	Winter	S. 22° E.	5.4	S. 22° E.	6.5	S. 7° W.	10.7	S. 29° W.	11.0	S. 73° W.	10.6	W.	12.0	.....	.....	.....	.....
	Annual	S. 22° E.	7.2	S. 23° E.	8.1	S. 8° E.	11.7	S. 1° W.	12.8	S. 28° W.	11.8	S. 48° W.	11.4	S. 37° W.	14.9	S. 68° W.	17.4
S	Spring	S.	8.2	S.	8.9	S. 6° W.	12.0	S. 9° W.	12.4	S. 17° W.	12.0	S. 28° W.	12.4	S. 59° W.	12.9	W.	13.9
	Summer	S.	6.5	S.	7.5	S. 5° W.	11.2	S. 7° W.	11.8	S. 21° W.	10.5	S. 31° W.	9.0	S. 66° W.	9.5	W.	9.7
	Autumn	S.	7.1	S. 3° W.	7.9	S. 15° W.	10.9	S. 21° W.	12.0	S. 45° W.	12.4	S. 61° W.	13.0	S. 70° W.	15.7	W.	16.1
	Winter	S.	5.8	S. 4° W.	6.8	S. 20° W.	10.8	S. 33° W.	12.2	S. 73° W.	12.6	N. 82° W.	15.2	N. 66° W.	17.3	.....	.....
	Annual	S.	6.9	S. 2° W.	7.8	S. 11° W.	11.2	S. 17° W.	12.1	S. 39° W.	11.9	S. 54° W.	12.4	S. 77° W.	13.8	W.	14.3
SSW	Spring	S. 22° W.	6.2	S. 24° W.	6.9	S. 34° W.	9.9	S. 48° W.	11.0	S. 57° W.	11.2	S. 74° W.	13.2	S. 83° W.	15.0	W.	15.7
	Summer	S. 22° W.	5.9	S. 24° W.	6.5	S. 29° W.	8.6	S. 37° W.	9.3	S. 59° W.	9.0	N. 87° W.	10.1	N. 89° W.	10.3	.....	.....
	Autumn	S. 22° W.	6.0	S. 26° W.	7.1	S. 39° W.	10.9	S. 48° W.	11.9	S. 62° W.	12.0	S. 72° W.	13.6	S. 82° W.	15.5	.....	.....
	Winter	S. 22° W.	6.1	S. 26° W.	6.9	S. 46° W.	10.0	S. 61° W.	11.0	S. 87° W.	11.8	N. 82° W.	15.7	N. 72° W.	20.6	N. 68° W.	20.5
	Annual	S. 22° W.	6.0	S. 25° W.	6.8	S. 37° W.	9.8	S. 48° W.	10.8	S. 66° W.	11.0	S. 84° W.	13.2	N. 80° W.	15.4	N. 79° W.	16.3
SW	Spring	S. 45° W.	9.1	S. 45° W.	10.3	S. 52° W.	14.7	S. 56° W.	15.1	S. 68° W.	14.5	N. 56° W.	16.4	.....	.....	.....	.....
	Summer	S. 45° W.	5.9	S. 48° W.	6.8	S. 56° W	8.1	S. 61° W.	9.7	W.	9.8	N. 76° W.	15.4	N. 79° W.	18.5	.....	.....
	Autumn	S. 45° W.	6.4	S. 45° W.	7.4	S. 61° W.	10.7	S. 64° W.	11.5	S. 76° W.	12.5	S. 75° W.	12.2	S. 67° W.	16.6	.....	.....
	Winter	S. 45° W.	5.7	S. 51° W.	7.0	S. 68° W.	11.9	S. 80° W.	12.3	N. 75° W.	16.0	N. 77° W.	19.0	W.	20.6	N. 79° W.	20.7
	Annual	S. 45° W.	6.8	S. 47° W.	7.9	S. 59° W.	11.6	S. 65° W.	12.2	S. 85° W.	13.2	N. 78° W.	15.8	S. 86° W.	18.2	N. 79° W.	18.3
WSW	Spring	S. 68° W.	6.7	S. 68° W.	7.7	S. 76° W.	10.7	S. 85° W.	12.1	W.	17.9	N. 67° W.	21.0	N. 68° W.	23.7	.....	.....
	Summer	S. 68° W.	4.7	S. 68° W.	5.5	S. 68° W.	8.0	S. 64° W.	9.2	N. 68° W.	10.3	N. 45° W.	12.9	.....	.....	.....	.....
	Autumn	S. 68° W.	5.8	S. 68° W.	6.9	S. 83° W.	11.0	S. 86° W.	11.7	S. 87° W.	12.3	N. 68° W.	15.8	N. 52° W.	19.4	N. 79° W.	22.2
	Winter	S. 68° W.	5.0	S. 71° W.	5.9	N. 87° W.	9.4	N. 77° W.	11.4	N. 67° W.	14.6	N. 60° W.	16.2	N. 54° W.	19.5	W.	19.9
	Annual	S. 68° W.	5.6	S. 69° W.	6.5	S. 80° W.	9.8	S. 85° W.	11.1	N. 79° W.	13.8	N. 60° W.	16.5	N. 58° W.	19.9	N. 84° W.	21.3
W	Spring	W.	7.4	W.	8.0	N. 81° W.	10.4	N. 78° W.	11.8	N. 73° W.	14.2	N. 81° W.	16.2	W.	17.9	.....	.....
	Summer	W.	7.2	W.	8.0	N. 82° W.	11.2	N. 77° W.	12.3	N. 78° W.	13.1	S. 74° W.	17.3	S. 79° W.	21.6	.....	.....
	Autumn	W.	6.7	N. 80° W.	7.8	N. 74° W.	11.3	N. 68° W.	12.2	N. 63° W.	13.8	N. 76° W.	17.2	N. 86° W.	19.7	W.	19.3
	Winter	W.	7.5	N. 87° W.	8.6	N. 71° W.	13.2	N. 67° W.	15.3	N. 55° W.	17.1	N. 58° W.	20.4	N. 45° W.	22.4	.....	.....
	Annual	W.	7.2	N. 89° W.	8.1	N. 77° W.	11.5	N. 72° W.	12.9	N. 67° W.	14.6	N. 80° W.	17.8	N. 81° W.	20.4	W.	20.0
WNW	Spring	N. 68° W.	7.4	N. 68° W.	7.9	N. 64° W.	10.1	N. 57° W.	11.1	N. 79° W.	12.5	S. 83° W.	17.4	W.	22.2	W.	24.6
	Summer	N. 68° W.	6.7	N. 69° W.	7.4	N. 63° W.	10.4	N. 63° W.	11.8	N. 64° W.	14.3	N. 68° W.	16.6	N. 70° W.	18.4	N. 45° W.	19.3
	Autumn	N. 68° W.	7.0	N. 66° W.	7.9	N. 56° W.	11.4	N. 51° W.	12.2	N. 48° W.	14.0	N. 57° W.	16.5	N. 63° W.	18.6	W.	13.7
	Winter	N. 68° W.	6.4	N. 68° W.	7.5	N. 57° W.	12.0	N. 50° W.	14.4	N. 51° W.	16.2	N. 61° W.	17.8	N. 71° W.	20.7	.....	.....
	Annual	N. 68° W.	6.9	N. 68° W.	7.7	N. 60° W.	11.0	N. 55° W.	12.4	N. 60° W.	14.2	N. 71° W.	17.1	N. 73° W.	20.0	N. 75° W.	20.1
NW	Spring	N. 45° W.	9.7	N. 45° W.	10.0	N. 41° W.	11.6	N. 40° W.	12.6	N. 46° W.	15.1	N. 60° W.	17.4	N. 83° W.	19.5	N. 68° W.	22.3
	Summer	N. 45° W.	6.9	N. 45° W.	7.5	N. 41° W.	9.5	N. 44° W.	9.7	N. 45° W.	11.7	N. 60° W.	13.4	N. 52° W.	15.9	S. 68° W.	19.8
	Autumn	N. 45° W.	8.0	N. 46° W.	8.7	N. 37° W.	11.9	N. 36° W.	12.7	N. 45° W.	14.4	N. 61° W.	16.8	N. 57° W.	19.7	.....	.....
	Winter	N. 45° W.	8.2	N. 44° W.	9.0	N. 37° W.	12.2	N. 37° W.	13.3	N. 45° W.	15.6	N. 57° W.	17.9	N. 63° W.	18.0	N. 84° W.	19.9
	Annual	N. 45° W.	8.2	N. 45° W.	8.8	N. 39° W.	11.3	N. 38° W.	12.1	N. 45° W.	14.2	N. 59° W.	16.4	N. 64° W.	18.3	N. 88° W.	20.9
NNW	Spring	N. 22° W.	9.4	N. 22° W.	9.7	N. 17° W.	11.0	N. 13° W.	11.4	N. 10° W.	11.9	N. 21° W.	13.6	N.	15.7	(1)	21.0
	Summer	N. 22° W.	7.6	N. 22° W.	8.0	N. 19° W.	9.8	N. 18° W.	10.2	N. 43° W.	9.3	N. 47° W.	9.4	N. 56° W.	13.4	W.	17.4
	Autumn	N. 22° W.	8.0	N. 22° W.	8.4	N. 15° W.	10.1	N. 12° W.	10.7	N. 16° W.	12.0	N. 28° W.	14.1	N. 30° W.	16.7	.....	.....
	Winter	N. 22° W.	9.0	N. 22° W.	9.5	N. 18° W.	11.7	N. 19° W.	12.2	N. 27° W.	13.2	N. 41° W.	14.6	N. 64° W.	16.2	S. 45° W.	19.5
	Annual	N. 22° W.	8.5	N. 22° W.	8.9	N. 17° W.	10.6	N. 16° W.	11.1	N. 24° W.	11.6	N. 34° W.	12.9	N. 38° W.	15.5	S. 68° W.	19.3
Means	Spring	N. 43° W.	8.3	N. 44° W.	8.8	N. 56° W.	10.8	N. 69° W.	11.4	S. 81° W.	11.9	S. 88° W.	13.2	N. 83° W.	14.9	N. 70° W.	17.2
	Summer	S. 16° E.	6.5	S. 16° E.	7.2	S. 10° E.	9.8	S. 40° W.	10.3	S. 65° W.	9.7	S. 87° W.	10.2	N. 81° W.	11.7	S. 87° W.	14.0
	Autumn	N. 58° W.	6.8	N. 60° W.	7.6	N. 51° W.	10.5	N. 56° W.	11.2	N. 80° W.	11.3	N. 75° W.	13.1	N. 81° W.	15.4	S. 82° W.	15.5
	Winter	N. 50° W.	7.2	N. 50° W.	7.9	N. 46° W.	10.8	N. 47° W.	11.7	N. 56° W.	13.0	N. 63° W.	15.1	N. 66° W.	17.4	N. 88° W.	18.7
	Annual	N. 65° W.	7.2	N. 66° W.	7.9	N. 67° W.	10.5	N. 77° W.	11.2	N. 88° W.	11.5	N. 81° W.	12.9	N. 78° W.	14.8	N. 87° W.	16.4

[1] Only 2 observations, 180° apart.

TABLE 9d.—*Average free-air winds at Groesbeck, Tex.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 141		500		750		1,000		2,000		3,000		4,000		5,000	
		Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
			m. p. s.		*m. p. s.*		*m. p. s.*		*m. p. s.*		*m. p. s.*		*m. p. s.*		*m. p. s.*		*m. p. s.*
N	Spring	N.	5.7	N. 2° W.	8.3	N. 7° W.	8.5	N. 8° W.	8.5	N. 45° W.	9.0	N. 68° W.	12.5				
	Summer	N.	4.2	N. 11° E.	5.5	N. 17° E.	4.3	N. 7° E.	3.0								
	Autumn	N.	6.1	N. 8° E.	9.2	N. 12° E.	8.4	N. 15° E.	7.6	N. 21° W.	7.4	N. 29° W.	9.3	N. 15° W.	11.7		
	Winter	N.	7.2	N. 8° E.	10.2	N. 9° E.	10.7	N. 11° E.	10.7	N. 24° W.	10.1	N. 52° W.	12.7	N. 45° W.	17.9	W.	21.9
	Annual	N.	5.8	N. 6° E.	8.3	N. 8° E.	8.0	N. 6° E.	7.4	N. 30° W.	6.9	N. 50° W.	9.6	N. 30° W.	12.5	W.	16.5
NNE	Spring	N. 22° E.	6.1	N. 22° E.	8.5	N. 22° E.	8.5	N. 23° E.	8.1	N. 6° W.	7.9	N. 58° W.	10.9	N. 68° W.	14.2	N. 68° W.	18.5
	Summer	N. 22° E.	5.0	N. 34° E.	5.0	N. 34° E.	5.0	N. 34° E.	6.0	S. 68° E.							
	Autumn	N. 22° E.	5.1	N. 32° E.	7.3	N. 37° E.	7.3	N. 35° E.	7.3	N. 21° E.	8.1	N. 7° E.	9.3	N. 34° E.	9.3		
	Winter	N. 22° E.	5.7	N. 35° E.	7.7	N. 39° E.	7.2	N. 38° E.	7.0	N. 23° E.	6.9	N. 33° W.	10.1	N. 68° W.	14.4	W.	
	Annual	N. 22° E.	5.5	N. 31° E.	7.1	N. 33° E.	7.0	N. 33° E.	7.1	N. 32° E.	7.3	N. 28° W.	9.7	N. 39° W.	12.2	N. 79° W.	16.4
NE	Spring	N. 45° E.	5.5	N. 45° E.	8.6	N. 50° E.	8.2	N. 50° E.	7.0	N. 11° E.	5.3	N. 68° W.	13.3				
	Summer	N. 45° E.	6.0	N. 60° E.	7.0	N. 60° E.	7.0	N. 60° E.	6.7	N. 45° E.	5.7						
	Autumn	N. 45° E.	5.3	N. 56° E.	10.9	N. 61° E.	10.8	N. 64° E.	10.1	N. 58° E.	8.7	N. 68° E.	10.0	N. 56° E.	11.0	N. 45° E.	11.0
	Winter	N. 45° E.	3.7	N. 62° E.	6.0	N. 65° E.	5.5	N. 79° E.	5.0	N. 68° W.	10.5						
	Annual	N. 45° E.	5.1	N. 56° E.	8.1	N. 59° E.	7.9	N. 63° E.	7.2	N. 18° E.	7.6	N.	12.5	N. 56° E.	13.5	N. 45° E.	13.5
ENE	Spring	N. 68° E.	6.0	N. 79° E.	9.2	N. 86° E.	9.4	N. 80° E.	8.4	N. 68° E.	5.2						
	Summer																
	Autumn	N. 68° E.	3.5	N. 84° E.	7.5	N. 89° E.	8.2	N. 85° E.	7.9	S. 87° E.	4.8	N. 22° E.	6.3				
	Winter	N. 68° E.	4.0	N. 45° E.	4.0	N. 45° E.	3.0	N. 22° E.	2.0								
	Annual	N. 68° E.	4.5	N. 70° E.	6.9	N. 74° E.	6.9	N. 66° E.	6.1	N. 80° E.	2.9	N. 22° E.	2.9				
E	Spring	E.	3.7	S. 64° E.	7.9	S. 48° E.	7.1	S. 34° E.	5.9	S. 11° W.	4.4						
	Summer	E.	4.5	S. 68° E.	7.0	S. 68° E.	6.8	S. 53° E.	5.8	S. 22° E.	5.8						
	Autumn	E.	3.2	S. 65° E.	10.4	S. 62° E.	9.8	S. 50° E.	8.8	S. 13° E.	5.9	S. 22° W.	7.9				
	Winter	E.	2.2	S. 56° E.	4.2	S. 30° E.	3.9	S. 30° E.	3.2								
	Annual	E.	3.4	S. 63° E.	7.4	S. 52° E.	6.9	S. 42° E.	5.9	S. 8° E.	4.4	S. 22° W.	6.4				
ESE	Spring	S. 68° E.	5.2	S. 51° E.	9.6	S. 41° E.	9.8	S. 33° E.	9.6	S. 16° E.	6.6	S. 22° E.	4.4				
	Summer	S. 68° E.	5.2	S. 55° E.	7.1	S. 54° E.	7.0	S. 50° E.	6.8	S. 52° E.	4.7	S. 45° E.	4.7				
	Autumn	S. 68° E.	4.2	S. 54° E.	9.7	S. 40° E.	9.6	S. 35° E.	9.6	S. 27° E.	8.2	S. 18° E.	5.9				
	Winter	S. 68° E.	4.2	S. 60° E.	9.1	S. 36° E.	10.2	S. 26° E.	10.5	S. 3° W.	10.7	S. 14° W.	13.2	S. 30° W.	12.7		
	Annual	S. 68° E.	4.7	S. 55° E.	8.9	S. 43° E.	9.2	S. 36° E.	9.1	S. 23° E.	7.6	S. 18° E.	7.0	S. 30° W.	6.5		
SE	Spring	S. 45° E.	4.7	S. 34° E.	10.2	S. 26° E.	11.0	S. 19° E.	11.1	S. 2° E.	11.7	S.	9.6				
	Summer	S. 45° E.	5.0	S. 53° E.	7.5	S. 49° E.	8.3	S. 39° E.	8.0	S. 34° E.	7.0						
	Autumn	S. 45° E.	4.4	S. 24° E.	10.7	S. 17° E.	11.8	S. 9° E.	12.0	S. 5° W.	10.7	S. 9° W.	10.0	S. 22° W.	11.0		
	Winter	S. 45° E.	3.9	S. 9° E.	13.1	S. 8° W.	14.7	S. 10° W.	15.3	S. 23° W.	12.7	S. 45° W.	9.2				
	Annual	S. 45° E.	4.5	S. 30° E.	10.4	S. 21° E.	11.4	S. 14° E.	11.6	S. 2° E.	10.5	S. 18° W.	8.8	S. 22° W.	9.6		
SSE	Spring	S. 22° E.	5.9	S. 8° E.	10.6	S. 5° E.	11.3	S. 5° W.	11.6	S. 17° W.	10.7	S. 31° W.	9.2	S. 68° W.	10.2		
	Summer	S. 22° E.	5.5	S. 15° E.	7.9	S. 11° E.	8.4	S. 13° E.	8.8	S. 11° E.	7.6	S. 1° E.	6.2	S. 22° E.	6.4		
	Autumn	S. 22° E.	4.4	S. 5° E.	10.7	S. 2° W.	11.0	S. 9° W.	11.2	S. 24° W.	10.2	S. 36° W.	9.3	S. 45° W.	9.9		
	Winter	S. 22° E.	4.5	S. 6° W.	14.2	S. 6° W.	16.2	S. 34° W.	16.7	S. 30° W.	12.4	S. 45° W.	12.4				
	Annual	S. 22° E.	5.1	S. 6° E.	10.8	S. 2° E.	11.7	S. 9° W.	12.1	S. 15° W.	10.2	S. 28° W.	9.3	S. 32° W.	9.9		
S	Spring	S.	7.4	S. 5° W.	12.7	S. 7° W.	14.2	S. 13° W.	15.0	S. 25° W.	13.9	S. 35° W.	14.9	S. 68° W.	17.8		
	Summer	S.	4.4	S. 4° W.	8.2	S. 8° W.	8.5	S. 14° W.	7.8	S. 16° W.	6.6	S. 34° W.	5.6	N. 22° W.	8.4		
	Autumn	S.	5.5	S. 9° W.	11.6	S. 12° W.	21.8	S. 16° W.	13.5	S. 21° W.	11.8	S. 31° W.	10.6	S. 49° W.	11.5	W.	15.0
	Winter	S.	5.3	S. 13° W.	13.2	S. 22° W.	14.9	S. 26° W.	15.8	S. 47° W.	13.5	S. 58° W.	14.4	S. 45° W.	19.1		
	Annual	S.	5.6	S. 8° W.	11.4	S. 12° W.	12.6	S. 17° W.	13.0	S. 27° W.	11.4	S. 39° W.	11.4	S. 74° W.	14.2	W.	17.4
SSW	Spring	S. 22° W.	8.1	S. 24° W.	11.9	S. 27° W.	12.1	S. 32° W.	12.3	S. 47° W.	10.8	S. 58° W.	10.9	S. 45° W.	11.9		
	Summer	S. 22° W.	5.7	S. 24° W.	9.7	S. 26° W.	10.0	S. 27° W.	10.0	S. 27° W.	6.3	S. 20° W.	3.7				
	Autumn	S. 22° W.	5.7	S. 26° W.	11.5	S. 33° W.	13.1	S. 37° W.	13.7	S. 41° W.	11.3	S. 46° W.	12.0	S. 15° W.	12.6		
	Winter	S. 22° W.	6.2	S. 29° W.	11.5	S. 35° W.	12.5	S. 36° W.	12.9	S. 50° W.	12.3	S. 63° W.	12.6	S. 68° W.	11.2	W.	11.2
	Annual	S. 22° W.	6.4	S. 26° W.	11.2	S. 30° W.	11.9	S. 33° W.	12.2	S. 41° W.	10.2	S. 47° W.	9.8	S. 43° W.	9.1	W.	9.1
SW	Spring	S. 45° W.	5.7	S. 52° W.	11.5	S. 50° W.	12.3	S. 59° W.	12.3	S. 60° W.	9.7	S. 45° W.	10.2				
	Summer	S. 45° W.	4.9	S. 44° W.	9.0	S. 46° W.	9.0	S. 44° W.	7.9	S. 36° W.	3.9	S. 51° W.	3.9				
	Autumn	S. 45° W.	4.5	S. 34° W.	9.5	S. 39° W.	9.7	S. 39° W.	10.2	S. 50° W.	9.9	S. 60° W.	9.6				
	Winter	S. 45° W.	5.6	S. 50° W.	11.2	S. 51° W.	11.6	S. 57° W.	11.6	S. 74° W.	11.4	N. 78° W.	12.9	N. 60° W.	15.2	N. 45° W.	18.2
	Annual	S. 45° W.	5.2	S. 45° W.	10.3	S. 47° W.	10.6	S. 50° W.	10.5	S. 55° W.	8.7	S. 64° W.	9.2	N. 60° W.	11.1	N. 45° W.	14.1
WSW	Spring	S. 68° W.	7.5	S. 60° W.	11.8	S. 60° W.	11.8	S. 63° W.	12.0	S. 72° W.	12.3	S. 68° W.	15.5	S. 68° W.	17.5		
	Summer	S. 68° W.	4.1	S. 65° W.	6.5	S. 68° W.	6.4	S. 67° W.	6.1	S. 63° W.	4.9	S. 68° W.	6.4				
	Autumn	S. 68° W.	6.2	S. 79° W.	10.2	S. 86° W.	11.0	S. 68° W.	11.0	S. 61° W.	11.8	N. 68° W.	17.1				
	Winter	S. 68° W.	4.5	S. 68° W.	15.5	S. 68° W.	17.0	S. 68° W.	17.0								
	Annual	S. 68° W.	5.6	S. 68° W.	11.0	S. 70° W.	11.6	S. 67° W.	11.5	S. 65° W.	12.1	S. 82° W.	15.4	S. 68° W.	17.4		
W	Spring	W.	17.0	W.	22.0	W.	22.0										
	Summer																
	Autumn	W.	3.3	N. 60° W.	10.3	N. 60° W.	12.0	N. 60° W.	11.7	N. 56° W.	13.3						
	Winter	W.	5.6	N. 81° W.	10.9	N. 77° W.	11.5	N. 71° W.	12.6	N. 76° W.	15.5	N. 79° W.	19.9	N. 45° W.	22.4		
	Annual	W.	8.6	N. 77° W.	14.4	N. 76° W.	15.2	N. 66° W.	15.6	N. 66° W.	18.1	N. 79° W.	22.5	N. 45° W.	25.0		
WNW	Spring	N. 68° W.	6.8	N. 68° W.	8.1	N. 68° W.	11.9	N. 73° W.	15.1	W.	17.1	S. 79° W.	23.6				
	Summer	N. 68° W.	5.0	N. 68° W.	7.0	N. 68° W.	7.0	N. 45° W.	7.0	N. 45° W.	8.0						
	Autumn	N. 68° W.	5.8	N. 51° W.	9.2	N. 51° W.	10.7	N. 51° W.	12.2	N. 56° W.	15.0	N. 68° W.	20.0				
	Winter	N. 68° W.	7.5	N. 62° W.	11.2	N. 62° W.	11.4	N. 58° W.	12.1	N. 61° W.	16.7	N. 62° W.	19.5	W.			
	Annual	N. 68° W.	6.3	N. 62° W.	8.9	N. 62° W.	10.2	N. 57° W.	11.6	N. 63° W.	14.2	N. 77° W.	19.0	W.			
NW	Spring	N. 45° W.	8.5	N. 39° W.	11.8	N. 45° W.	12.8	N. 51° W.	13.8	N. 62° W.	15.5	N. 68° W.	18.5				
	Summer																
	Autumn	N. 45° W.	5.1	N. 45° W.	11.2	N. 39° W.	12.0	N. 47° W.	11.6	N. 57° W.	12.4	N. 67° W.	14.0	N. 68° W.	20.0		
	Winter	N. 45° W.	6.0	N. 48° W.	10.0	N. 43° W.	11.2	N. 45° W.	12.4	N. 53° W.	16.2	N. 63° W.	19.2	N. 68° W.	23.0		
	Annual	N. 45° W.	6.5	N. 44° W.	11.0	N. 42° W.	12.0	N. 48° W.	12.6	N. 57° W.	14.7	N. 66° W.	17.2	N. 68° W.	22.1		
NNW	Spring	N. 22° W.	8.1	N. 30° W.	12.0	N. 28° W.	12.9	N. 28° W.	13.2	N. 38° W.	17.2	N. 46° W.	20.1	N. 68° W.	23.1		
	Summer	N. 22° W.	5.8	N. 18° W.	9.4	N. 18° W.	9.4	N. 18° W.	8.2	N. 30° W.	9.7	N. 56° W.	10.7	W.	12.7		
	Autumn	N. 22° W.	5.8	N. 17° W.	10.2	N. 20° W.	11.1	N. 20° W.	11.5	N. 29° W.	14.5	N. 49° W.	17.7				
	Winter	N. 22° W.	6.4	N. 15° W.	9.8	N. 13° W.	10.1	N. 18° W.	10.6	N. 34° W.	14.0	N. 52° W.	18.4	N.	18.4		
	Annual	N. 22° W.	6.5	N. 20° W.	10.4	N. 20° W.	10.9	N. 21° W.	10.9	N. 33° W.	13.8	N. 51° W.	16.7	N. 55° W.	18.4		
Means	Spring	S. 12° E.	6.7	S. 2° W.	10.9	S. 8° W.	11.6	S. 20° W.	11.8	S. 44° W.	11.2	S. 57° W.	12.1	S. 87° W.	14.3	N. 68° W.	18.1
	Summer	S. 7° W.	5.0	S. 9° W.	8.3	S. 11° W.	8.4	S. 16° W.	8.0	S. 20° W.	5.7	S. 25° W.	4.6	W.	5.2		
	Autumn	S. 48° E.	5.1	S. 22° E.	10.3	S. 6° E.	10.8	S. 10° W.	10.9	S. 43° W.	10.2	S. 52° W.	10.5	S. 57° W.	11.7	N. 23° W.	13.5
	Winter	N. 52° W.	5.8	N. 69° W.	10.5	N. 82° W.	11.2	S. 87° W.	11.5	S. 85° W.	11.8	S. 86° W.	13.7	N. 86° W.	16.0	N. 79° W.	18.0
	Annual	S. 1° E.	5.6	S. 16° W.	10.0	S. 23° W.	10.5	S. 33° W.	10.6	S. 48° W.	9.7	S. 55° W.	10.2	S. 84° W.	11.8	N. 57° W.	14.6

TABLE 9e.—*Average free-air winds at Leesburg, Ga.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 85		500		750		1,000		2,000		3,000		4,000		5,000	
		Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
			m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.
N.	Spring	N.	6.2	N. 6° W.	8.0	N. 6° E.	8.5	N.	11.0								
	Summer	N.	4.0	N.	8.0	N.	6.0	N.	3.0								
	Autumn	N.	5.0	N.	10.5	N.	9.5	N.	9.5	N. 11° W.	8.0	N. 11° W.	10.5	N.	12.5		
	Winter	N.	4.3	N.	8.0	N. 7° E.	7.3	N. 7° E.	7.3	N. 22° W.	10.3	N. 45° W.	12.8	N. 45° W.	14.8	N. 45° W.	19.8
	Annual	N.	4.9	N. 2° W.	8.6	N. 3° E.	8.1	N. 2° E.	7.7	N. 17° W.	8.0	N. 28° W.	10.4	N. 22° W.	12.4	N. 45° W.	15.9
NNE.	Spring	N. 22° E.	4.8	N. 14° E.	5.2	N.	5.5	N. 11° W.	5.0								
	Summer																
	Autumn	N. 22° E.	4.5	N. 22° E.	6.0	N. 34° E.	6.5	N. 22° E.	7.5								
	Winter	N. 22° E.	4.8	N. 39° E.	8.8	N. 44° E.	9.1	N. 44° E.	8.4	N. 45° E.	5.2	N. 22° E.	6.7				
	Annual	N. 22° E.	4.7	N. 25° E.	6.7	N. 26° E.	7.0	N. 18° E.	7.0	N. 45° E.	4.9	N. 22° E.	6.4				
NE.	Spring	N. 45° E.	4.5	N. 28° E.	5.7	N. 39° E.	6.0	N. 35° E.	5.3	N. 22° E.	9.3						
	Summer	N. 45° E.	6.0	N. 45° E.	7.0	N. 45° E.	8.0	N. 45° E.	8.0	N. 45° E.	7.0						
	Autumn	N. 45° E.	6.0	N. 49° E.	9.8	N. 49° E.	8.6	N. 54° E.	7.8	N. 52° E.	5.3	N. 86° E.	4.8				
	Winter	N. 45° E.	5.8	N. 59° E.	12.0	N. 73° E.	13.0	N. 75° E.	10.8	N. 22° W.	6.8						
	Annual	N. 45° E.	5.6	N. 45° E.	8.6	N. 51° E.	8.9	N. 52° E.	8.0	N. 25° E.	7.1	N. 56° E.	7.9				
ENE.	Spring	N. 68° E.	5.4	N. 72° E.	10.6	N. 81° E.	11.4	N. 89° E.	11.4	S. 56° E.	12.4		13.4				
	Summer	N. 68° E.	5.7	N. 83° E.	7.5	N. 86° E.	8.2	N. 89° E.	8.2	N. 84° E.	8.2	N. 79° E.	11.4	E.	10.4		
	Autumn	N. 68° E.	4.5	N. 71° E.	6.8	N. 78° E.	5.6	N. 78° E.	5.1	N. 68° E.	5.1	N. 68° E.	2.1				
	Winter	N. 68° E.	5.3	N. 82° E.	10.3	N. 81° E.	9.7	N. 84° E.	8.2	N. 54° E.	5.2	N. 68° E.	4.2				
	Annual	N. 68° E.	5.2	N. 77° E.	8.8	N. 82° E.	8.7	N. 85° E.	8.2	N. 82° E.	7.7	N. 72° E.	7.8	E.	8.1		
E.	Spring	E.	5.7	E.	9.0	S. 86° E.	10.4	S. 75° E.	11.4	S. 45° E.	6.9						
	Summer	E.	5.1	N. 88° E.	10.4	E.	11.6	S. 88° E.	12.6	S. 84° E.	12.2	S. 83° E.	7.9				
	Autumn	E.	4.7	N. 88° E.	8.8	E.	8.6	N. 86° E.	7.9	N. 87° E.	6.4	E.	5.8				
	Winter	E.	4.0	S. 45° E.	10.5	S. 45° E.	11.0	S. 22° W.	11.0								
	Annual	E.	4.9	S. 80° E.	9.7	S. 78° E.	10.4	S. 66° E.	10.7	S. 74° E.	7.4	S. 86° E.	4.9				
ESE.	Spring	S. 68° E.	4.6	S. 61° E.	8.0	S. 55° E.	9.2	S. 38° E.	10.5								
	Summer	S. 68° E.	4.2	S. 67° E.	7.7	S. 67° E.	7.7	S. 60° E.	7.7	S. 56° E.	9.2	S. 56° E.	8.2				
	Autumn	S. 68° E.	4.7	S. 68° E.	9.7	S. 52° E.	10.0	S. 34° E.	11.5	S. 11° E.	9.0	S.	7.0	S. 22° W.	9.0		
	Winter	S. 68° E.	3.0	S. 68° E.	3.0	S. 45° E.	2.0										
	Annual	S. 68° E.	4.1	S. 66° E.	7.1	S. 55° E.	7.2	S. 44° E.	8.1	S. 34° E.	8.1	S. 28° E.	6.6	S. 22° W.	8.0		
SE.	Spring	S. 45° E.	5.6	S. 32° E.	13.8	S. 18° E.	13.8	S. 7° W.	13.5	S. 30° W.	14.2	S. 45° W.	17.2	S. 68° W.	20.2	S. 68° W.	20.2
	Summer	S. 45° E.	5.5	S. 34° E.	8.5	S. 22° E.	10.5	S. 22° E.	12.5	S. 11° E.	13.5	S.	14.5				
	Autumn	S. 45° E.	3.2	S. 45° E.	7.5	S. 45° E.	7.3	S. 45° E.	6.3	S. 45° E.	5.8						
	Winter																
	Annual	S. 45° E.	4.8	S. 37° E.	9.9	S. 28° E.	10.5	S. 20° E.	10.8	S. 9° E.	11.2	S. 22° W.	13.5	S. 68° W.	16.0	S. 68° W.	16.0
SSE.	Spring	S. 22° E.	5.6	S. 20° E.	10.5	S. 17° E.	11.7	S. 9° E.	11.8	S. 45° W.	11.7	S. 68° W.	9.7				
	Summer																
	Autumn	S. 22° E.	3.3	S. 15° E.	10.6	S. 7° E.	10.9	S.	8.9	S. 22° W.	5.9						
	Winter	S. 22° E.	6.0	S.	11.7	S. 7° W.	13.4	S. 11° W.	13.4	S. 22° W.	13.4	S. 45° W.	10.9	S. 45° W.	10.9		
	Annual	S. 22° E.	4.6	S. 12° E.	10.9	S. 6° E.	12.0	S. 1° W.	11.4	S. 30° W.	10.3	S. 56° W.	8.1	S. 45° W.	8.1		
S.	Spring	S.	5.1	S. 6° W.	10.9	S. 12° W.	12.0	S. 14° W.	11.9	S. 26° W.	13.6	S. 50° W.	17.8	S. 56° W.	17.3	W.	20.3
	Summer	S.	6.0	S.	8.0	S.	7.0	S.	6.5								
	Autumn	S.	5.7	S.	18.7	S. 15° W.	18.4	S. 22° W.	17.4	S. 52° W.	15.1	S. 56° W.	19.1				
	Winter	S.	5.6	S. 3° W.	11.6	S. 11° W.	12.8	S. 18° W.	13.6	S. 32° W.	14.7	S. 35° W.	15.1				
	Annual	S.	5.6	S. 2° W.	12.3	S. 10° W.	12.6	S. 14° W.	12.4	S. 37° W.	12.4	S. 47° W.	14.6	S. 56° W.	15.8	W.	18.8
SSW.	Spring	S. 22° W.	6.2	S. 24° W.	10.8	S. 25° W.	12.6	S. 28° W.	13.4	S. 45° W.	14.0	S. 68° W.	16.5				
	Summer	S. 22° W.	4.3	S. 22° W.	7.6	S. 16° W.	8.3	S. 22° W.	9.3	S. 22° W.	9.3	S. 22° W.	7.3				
	Autumn	S. 22° W.	4.0	S. 16° W.	8.4	S. 16° W.	8.1	S. 22° W.	8.1	S. 34° W.	11.1	S. 45° W.	12.1	S. 45° W.	15.1		
	Winter	S. 22° W.	4.6	S. 36° W.	13.8	S. 44° W.	16.0	S. 50° W.	16.0	S. 67° W.	20.5	S. 45° W.	20.0				
	Annual	S. 22° W.	4.8	S. 24° W.	10.2	S. 25° W.	11.2	S. 30° W.	11.7	S. 42° W.	13.7	S. 45° W.	14.0	S. 45° W.	16.2		
SW.	Spring	S. 45° W.	5.5	S. 57° W.	9.5	S. 56° W.	9.8	S. 60° W.	9.6	S. 79° W.	11.8	W.	12.3				
	Summer	S. 45° W.	6.6	S. 36° W.	9.0	S. 36° W.	9.8	S. 30° W.	11.1								
	Autumn	S. 45° W.	4.0	S. 45° W.	11.0	S. 45° W.	10.0	S. 45° W.	9.0	S. 45° W.	10.0	S. 45° W.	13.0	S. 45° W.	16.0		
	Winter	S. 45° W.	3.4	S. 61° W.	10.8	S. 64° W.	10.8	S. 71° W.	11.6	S. 81° W.	15.4	W.	16.4	N. 78° W.	17.1		
	Annual	S. 45° W.	4.9	S. 50° W.	10.1	S. 50° W.	10.1	S. 52° W.	10.3	S. 68° W.	12.4	S. 75° W.	13.9	S. 74° W.	16.7		
WSW.	Spring	S. 68° W.	6.0	S. 45° W.	9.0	S. 45° W.	9.0	S. 45° W.	9.0	S. 68° W.	12.0						
	Summer	S. 68° W.	5.3	S. 47° W.	7.3	S. 47° W.	7.3	S. 56° W.	7.3	S. 68° W.	10.3	S. 68° W.	11.3	S. 45° W.	10.3		
	Autumn	S. 68° W.	3.0	S. 79° W.	5.5	S. 79° W.	5.5	S. 79° W.	4.5								
	Winter	S. 68° W.	6.2	S. 72° W.	10.5	S. 75° W.	11.2	S. 80° W.	12.2	N. 87° W.	15.3	N. 77° W.	16.2	W.	17.2		
	Annual	S. 68° W.	5.1	S. 61° W.	8.1	S. 61° W.	8.2	S. 65° W.	8.2	S. 74° W.	11.3	S. 86° W.	12.3	S. 68° W.	12.3		
W.	Spring	W.	6.0	W.	8.5	N. 79° W.	9.0	N. 68° W.	10.0	W.	9.5	N. 68° W.	15.5				
	Summer	W.	5.3	S. 88° W.	7.2	S. 87° W.	7.8	S. 86° W.	8.6	S. 85° W.	11.6	S. 83° W.	11.9	S. 56° W.	10.9		
	Autumn	W.	4.0	W.	6.0	W.	6.0		5.0	W.	12.0	W.	16.0				
	Winter	W.	5.3	W.	8.5	N. 87° W.	9.1	N. 84° W.	10.3	N. 82° W.	16.0	N. 68° W.	19.8				
	Annual	W.	5.2	W.	7.6	N. 87° W.	8.0	N. 84° W.	8.5	N. 89° W.	12.3	N. 81° W.	15.8	S. 56° W.	16.7		
WNW.	Spring	N. 68° W.	7.1	N. 73° W.	9.5	N. 73° W.	9.9	N. 74° W.	10.5	N. 84° W.	14.2	N. 86° W.	19.1	W.	21.6		
	Summer	N. 68° W.	4.0	N. 56° W.	6.0	N. 45° W.	5.5	N. 30° W.	5.5	N. 22° E.	4.5						
	Autumn	N. 68° W.	3.0	W.	7.0	W.	7.0	N. 68° W.	8.0	N. 68° W.	9.0	N. 68° W.	20.0	W.	23.0		
	Winter	N. 68° W.	6.5	N. 56° W.	10.0	N. 54° W.	11.4	N. 54° W.	12.9	N. 50° W.	18.4	N. 63° W.	21.5				
	Annual	N. 68° W.	5.2	N. 69° W.	8.1	N. 65° W.	8.4	N. 57° W.	9.2	N. 51° W.	11.5	N. 72° W.	17.9	W.	19.7		
NW.	Spring	N. 45° W.	5.2	N. 49° W.	6.9	N. 45° W.	7.7	N. 45° W.	8.5	N. 53° W.	14.7	N. 45° W.	19.0	N. 22° W.	18.0		
	Summer	N. 45° W.	5.5	N. 68° W.	6.0	N. 56° W.	6.0	W.	6.0	N. 68° W.	7.0	N. 68° W.	7.0				
	Autumn																
	Winter	N. 45° W.	6.4	N. 42° W.	9.4	N. 45° W.	10.8	N. 48° W.	11.9	N. 61° W.	15.2	N. 73° W.	19.0				
	Annual	N. 45° W.	5.7	N. 53° W.	7.4	N. 49° W.	8.2	N. 61° W.	8.8	N. 61° W.	12.3	N. 62° W.	15.0	N. 22° W.	14.5		
NNW.	Spring	N. 22° W.	5.0	N. 38° W.	8.3	N. 30° W.	10.0	N. 30° W.	10.7	N. 45° W.	15.1	N. 56° W.	17.6	N. 68° W.	21.6		
	Summer																
	Autumn	N. 22° W.	4.3	N. 22° W.	8.6	N. 8° W.	8.9	N. 8° W.	9.2	N. 50° W.	12.8	N. 60° W.	16.5	W.	23.2	W.	22.2
	Winter	N. 22° W.	6.0	N. 22° W.	9.6	N. 30° W.	9.9	N. 30° W.	10.9	N. 45° W.	12.8	N. 56° W.	20.3	N. 68° W.	20.3		
	Annual	N. 22° W.	5.1	N. 27° W.	8.8	N. 23° W.	9.6	N. 23° W.	10.3	N. 47° W.	13.6	N. 57° W.	18.1	N. 75° W.	21.7	W.	20.7
Means.	Spring	S. 4° E.	5.6	S. 19° W.	9.4	S. 30° W.	10.4	S. 46° W.	10.8	S. 66° W.	12.9	S. 82° W.	15.5	S. 88° W.	17.0	S. 79° W.	18.5
	Summer	S. 44° E.	5.3	S. 36° E.	8.2	S. 28° E.	8.8	S. 45° E.	9.3	S. 68° E.	9.9	S. 15° E.	9.3	S. 11° W.	8.5		
	Autumn	N. 88° E.	4.5	N. 89° E.	9.1	S. 80° E.	9.4	S. 89° E.	8.9	S. 65° E.	8.5	S. 84° W.	10.3	S. 66° W.	14.5	W.	16.3
	Winter	S. 82° W.	5.4	S. 84° W.	10.4	S. 84° W.	11.2	N. 86° W.	11.6	N. 83° W.	13.7	N. 87° W.	15.5	N. 83° W.	16.3	N. 45° W.	21.3
	Annual	S. 23° E.	5.2	S. 1° E.	9.3	S. 1° W.	10.0	S.	10.2	S. 4° W.	11.2	S. 67° W.	12.6	S. 67° W.	14.1	N. 79° W.	16.4

TABLE 91.—*Average free-air winds at Royal Center, Ind.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 225		500		750		1,000		2,000		3,000		4,000		5,000	
		Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
			m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.		m. p. s.
N	Spring	N.	10.0	N. 11° W.	13.7	N. 17° W.	14.2	N. 11° W.	13.7	N. 30° W.	14.7	N. 22° E.	17.7				
	Summer	N.	5.6	N. 7° E.	8.6	N. 10° E.	8.7	N. 15° E.	8.6	N. 1° W.	7.4	N. 11° W.	9.3				
	Autumn	N.	5.5	N.	7.5	N.	7.5	N.	7.5	N. 7° W.	8.0	N. 45° W.	5.0				
	Winter	N.	4.0	N. 45° E.	6.0	N. 45° E.	6.0	N. 45° E.	7.0	N.	6.0						
	Annual	N.	6.3	N. 10° E.	9.0	N. 9° E.	9.1	N. 12° E.	9.2	N. 9° W.	9.0	N. 11° W.	9.6				
NNE	Spring	N. 22° E.	5.7	N. 26° E.	6.7	N. 22° E.	7.7	N. 25° E.	8.1	N. 5° E.	9.3	N. 4° E.	9.3				
	Summer	N. 22° E.	5.7	N. 22° E.	6.1	N. 22° E.	6.5	N. 18° E.	7.1	N. 14° E.	8.9	N. 22° W.	7.1				
	Autumn	N. 22° E.	5.6	N. 21° E.	6.7	N. 22° E.	7.0	N. 17° E.	7.1	N. 5° W.	6.1	N. 6° W.	7.6	N.	9.6		
	Winter	N. 22° E.	6.0	N. 22° E.	7.7	N. 15° E.	7.7	N. 8° E.	9.0	N.	10.5						
	Annual	N. 22° E.	5.8	N. 20° E.	6.8	N. 20° E.	7.2	N. 17° E.	7.8	N. 3° E.	8.7	N. 8° W.	9.2	N.	11.4		
NE	Spring	N. 45° E.	7.4	N. 45° E.	8.4	N. 45° E.	9.2	N. 45° E.	9.0	N. 36° E.	6.2	N. 68° W.	5.7				
	Summer	N. 45° E.	3.8	N. 45° E.	6.5	N. 50° E.	7.0	N. 59° E.	6.8	N.	7.2	N. 45° W.	8.2				
	Autumn	N. 45° E.	5.8	N. 54° E.	7.2	N. 58° E.	7.6	N. 56° E.	6.8	N. 11° E.	7.0	N. 68° W.	12.0				
	Winter	N. 45° E.	6.7	N. 45° E.	7.0	N. 38° E.	6.3	N. 38° E.	6.6	N. 11° E.	5.6	N. 22° E.	4.6				
	Annual	N. 45° E.	5.9	N. 47° E.	7.3	N. 48° E.	7.5	N. 50° E.	7.3	N. 14° E.	6.5	N. 43° W.	7.6				
ENE	Spring	N. 68° E.	6.2	N. 62° E.	7.9	N. 62° E.	7.7	N. 68° E.	7.5	N. 56° E.	9.0	N. 56° E.	6.0				
	Summer	N. 68° E.	5.3	N. 75° E.	10.0	N. 75° E.	9.3	N. 82° E.	8.0		E.	10.8	N. 45° E.	1.8			
	Autumn	N. 68° E.	2.0	N. 68° E.	7.0	N. 68° E.	6.0	N. 68° E.	6.0								
	Winter	N. 68° E.	6.8	N. 70° E.	8.7	N. 73° E.	8.3	N. 71° E.	6.9	N. 79° E.	4.6	N. 79° E.	4.1				
	Annual	N. 68° E.	5.1	N. 69° E.	8.4	N. 70° E.	7.8	N. 72° E.	7.1	N. 75° E.	7.8	N. 60° E.	3.7				
E	Spring	E.	7.2	S. 87° E.	9.8	S. 84° E.	10.7	S. 76° E.	10.2	S. 85° E.	8.0	S. 75° E.	7.7	N. 79° E.	8.4		
	Summer	E.	5.4	S. 82° E.	6.9	S. 82° E.	7.8	S. 80° E.	6.5	N. 75° E.	1.9	E.	0.0				
	Autumn	E.	6.0	E.	7.8	E.	7.9	E.	6.5	S. 84° E.	2.7						
	Winter	E.	6.7	S. 79° E.	7.9	S. 75° E.	7.7	S. 76° E.	6.5	S. 68° E.	7.4		6.4				
	Annual	E.	6.3	S. 85° E.	8.1	S. 83° E.	8.5	S. 80° E.	7.4	S. 85° E.	5.0	S. 83° E.	4.0	N. 79° E.	4.8		
ESE	Spring	S. 68° E.	6.4	S. 68° E.	8.0	S. 63° E.	7.8	S. 62° E.	7.6	S. 77° E.	4.8	E.	4.3				
	Summer	S. 68° E.	5.0	S. 63° E.	7.4	S. 53° E.	7.8	S. 38° E.	7.5	S. 15° E.	4.5	S. 45° W.	6.5				
	Autumn	S. 68° E.	4.9	S. 45° E.	7.6	S. 39° E.	8.2	S. 31° E.	7.9	S. 5° E.	6.4	S. 22° W.	7.9				
	Winter	S. 68° E.	6.0	S. 63° E.	11.6	S. 46° E.	11.6	S. 51° E.	10.2	S.	11.3	S. 24° W.	14.3				
	Annual	S. 68° E.	5.6	S. 60° E.	8.6	S. 50° E.	8.8	S. 45° E.	8.3	S. 23° E.	6.8	S. 11° W.	8.2				
SE	Spring	S. 45° E.	6.7	S. 35° E.	11.2	S. 29° E.	13.2	S. 30° E.	13.7	S.	14.7	S. 45° W.	15.7				
	Summer	S. 45° E.	4.9	S. 25° E.	6.7	S. 11° E.	6.7	S. 5° W.	6.1	S. 34° W.	5.5	S. 45° W.	12.5				
	Autumn	S. 45° E.	3.6	S. 34° E.	7.6	S. 22° E.	8.1	S. 24° E.	7.5	S. 22° W.	8.0	S. 56° W.	12.0	S. 45° W.	12.0		
	Winter	S. 45° E.	6.1	S. 22° E.	10.3	S. 10° E.	12.3	S. 3° E.	12.5	S. 32° W.	13.9	S. 68° W.	16.1				
	Annual	S. 45° E.	5.3	S. 29° E.	9.0	S. 19° E.	10.1	S. 13° E.	10.0	S. 22° W.	10.5	S. 53° W.	14.1	S. 45° W.	14.2		
SSE	Spring	S. 22° E.	7.0	S.	11.1	S. 10° W.	13.0	S. 20° W.	13.9	S. 34° W.	14.1	S. 45° W.	15.6	S. 52° W.	17.9		
	Summer	S. 22° E.	3.2	S. 12° E.	5.7	S. 9° E.	5.9	S. 7° E.	6.7	S. 45° W.	10.2	W.	11.2				
	Autumn	S. 22° E.	5.4	S. 14° E.	9.6	S. 14° E.	11.1	S. 7° E.	11.2	S. 12° W.	12.7	S. 17° W.	13.7				
	Winter	S. 22° E.	5.3	S. 3° E.	11.4	S. 15° W.	14.0	S. 22° W.	14.9	S. 39° W.	15.3	S. 59° W.	14.5	S. 56° W.	18.0		
	Annual	S. 22° E.	5.2	S. 7° E.	9.4	S.	11.0	S. 7° W.	11.7	S. 33° W.	13.1	S. 53° W.	13.8	S. 54° W.	15.6		
S	Spring	S.	7.1	S. 21° W.	11.8	S. 24° W.	13.9	S. 30° W.	13.9	S. 47° W.	13.4	S. 64° W.	15.9	N. 79° W.	16.9		
	Summer	S.	3.8	S. 15° W.	7.8	S. 24° W.	9.1	S. 34° W.	8.7	S. 31° W.	8.3	S. 45° W.	15.3			N. 45° W.	20.9
	Autumn	S.	4.8	S. 15° W.	7.8	S. 24° W.	9.0	S. 30° W.	9.7	S. 34° W.	11.0	S. 51° W.	12.2	S. 63° W.	14.7		
	Winter	S.	4.2	S. 18° W.	10.8	S. 27° W.	12.4	S. 41° W.	13.0	S. 68° W.	13.8	S. 79° W.	16.1	S. 45° W.	15.6		
	Annual	S.	5.0	S. 17° W.	9.6	S. 25° W.	11.1	S. 34° W.	11.3	S. 45° W.	11.6	S. 58° W.	14.9	S. 60° W.	16.3		
SSW	Spring	S. 22° W.	6.6	S. 37° W.	11.6	S. 45° W.	13.8	S. 48° W.	14.8	S. 58° W.	15.1	S. 62° W.	13.9	W.	11.9	N. 45° W.	18.8
	Summer	S. 22° W.	5.2	S. 34° W.	8.2	S. 40° W.	9.6	S. 50° W.	10.0	S. 54° W.	11.8	S. 69° W.	12.8	S. 68° W.	14.6		
	Autumn	S. 22° W.	5.2	S. 32° W.	9.1	S. 36° W.	11.2	S. 42° W.	11.9	S. 49° W.	14.2	S. 58° W.	13.5	S. 68° W.	15.3		
	Winter	S. 22° W.	5.7	S. 32° W.	12.1	S. 37° W.	16.3	S. 47° W.	16.9	S. 59° W.	19.1	S. 52° W.	22.4	S. 45° W.	25.4		
	Annual	S. 22° W.	5.7	S. 34° W.	10.2	S. 40° W.	12.7	S. 47° W.	13.4	S. 55° W.	15.0	S. 60° W.	15.6	S. 68° W.	16.8		
SW	Spring	S. 45° W.	6.3	S. 52° W.	12.6	S. 54° W.	15.8	S. 58° W.	16.7	S. 64° W.	18.1	S. 79° W.	20.1	N. 68° W.	23.8		
	Summer	S. 45° W.	5.4	S. 52° W.	8.5	S. 55° W.	9.5	S. 59° W.	9.8	S. 69° W.	10.2	S. 72° W.	10.7	S. 72° W.	12.5		
	Autumn	S. 45° W.	5.4	S. 57° W.	9.4	S. 57° W.	11.1	S. 60° W.	12.0	S. 69° W.	14.0	S. 83° W.	15.6	N. 75° W.	17.7		
	Winter	S. 45° W.	6.2	S. 56° W.	10.4	S. 62° W.	12.9	S. 71° W.	14.2	S. 81° W.	18.2	S. 86° W.	20.2				
	Annual	S. 45° W.	5.8	S. 53° W.	10.2	S. 57° W.	12.3	S. 62° W.	13.2	S. 71° W.	15.1	S. 80° W.	16.6	N. 83° W.	19.1		
WSW	Spring	S. 68° W.	8.8	S. 68° W.	12.1	S. 69° W.	14.1	S. 74° W.	15.0	S. 85° W.	17.6	N. 87° W.	20.0	S. 45° W.	24.7		
	Summer	S. 68° W.	5.3	S. 68° W.	7.9	S. 70° W.	9.1	S. 74° W.	9.4	S. 72° W.	10.2	S. 70° W.	10.7	N. 79° W.	11.5		
	Autumn	S. 68° W.	5.1	S. 70° W.	8.4	S. 76° W.	10.1	S. 83° W.	10.7	N. 83° W.	12.6	N. 82° W.	13.5	N. 45° W.	12.6		
	Winter	S. 68° W.	5.9	S. 72° W.	8.8	S. 73° W.	10.4	S. 81° W.	12.0	S. 81° W.	15.7	S. 73° W.	19.8				
	Annual	S. 68° W.	6.3	S. 70° W.	9.3	S. 72° W.	10.9	S. 78° W.	11.8	S. 84° W.	14.0	S. 83° W.	16.0	N. 85° W.	17.7		
W	Spring	W.	7.6	N. 89° W.	9.5	N. 89° W.	11.0	N. 85° W.	11.4	N. 86° W.	15.3	N. 84° W.	16.9	N. 75° W.	19.4		
	Summer	W.	5.0	N. 87° W.	7.7	W.	8.4	S. 89° W.	9.1	S. 89° W.	11.7	S. 82° W.	14.5	N. 68° W.	17.3		
	Autumn	W.	6.0	N. 87° W.	8.8	N. 81° W.	10.2	N. 79° W.	10.8	N. 82° W.	12.2	N. 70° W.	16.1	N. 68° W.			
	Winter	W.	6.6	N. 79° W.	9.3	N. 77° W.	10.9	N. 74° W.	11.9	N. 74° W.	16.7	N. 81° W.	18.9	S. 68° W.	21.3		
	Annual	W.	6.3	N. 86° W.	8.8	N. 84° W.	10.1	N. 82° W.	10.8	N. 83° W.	14.0	N. 83° W.	16.6	N. 80° W.	19.1		
WNW	Spring	N. 68° W.	6.8	N. 68° W.	7.6	N. 68° W.	8.4	N. 62° W.	9.4	N. 52° W.	15.9	N. 56° W.	18.9	N. 45° W.	20.4		
	Summer	N. 68° W.	4.4	N. 63° W.	7.2	N. 59° W.	8.6	N. 63° W.	8.0	N. 79° W.	8.6	N. 60° W.	11.9				
	Autumn	N. 68° W.	5.6	N. 66° W.	8.1	N. 64° W.	9.7	N. 60° W.	10.0	N. 62° W.	11.8	N. 82° W.	13.1	W.	15.9		
	Winter	N. 68° W.	6.2	N. 72° W.	8.4	N. 75° W.	9.6	N. 75° W.	10.5	N. 77° W.	14.8	N. 81° W.	18.6	N. 79° W.	21.1		
	Annual	N. 68° W.	5.8	N. 67° W.	7.8	N. 66° W.	9.1	N. 65° W.	9.5	N. 68° W.	12.8	N. 70° W.	15.6	N. 72° W.	18.4		
NW	Spring	N. 45° W.	8.8	N. 49° W.	8.8	N. 41° W.	8.8	N. 40° W.	8.8	N. 45° W.	13.6	N. 56° W.	12.1				
	Summer	N. 45° W.	5.2	N. 41° W.	6.4	N. 38° W.	7.1	N. 41° W.	7.5	N. 41° W.	11.1	N. 53° W.	12.1	W.	18.1		
	Autumn	N. 45° W.	5.4	N. 41° W.	6.8	N. 43° W.	7.4	N. 41° W.	7.6	N. 52° W.	9.1	N. 68° W.	9.6				
	Winter	N. 45° W.	6.7	N. 45° W.	9.7	N. 45° W.	11.0	N. 45° W.	11.7	N. 68° W.	14.9	N. 68° W.	21.9				
	Annual	N. 45° W.	6.5	N. 44° W.	7.9	N. 42° W.	8.6	N. 42° W.	8.9	N. 51° W.	12.2	N. 61° W.	13.9	W.	19.9		
NNW	Spring	N. 22° W.	6.4	N. 22° W.	8.0	N. 22° W.	9.0	N. 36° W.	10.0	N. 28° W.	13.3	N. 34° W.	17.8	N. 45° W.	16.8		
	Summer	N. 22° W.	5.8	N. 18° W.	6.7	N. 26° W.	6.5	N. 27° W.	6.5	N. 42° W.	8.7	N. 39° W.	12.7				
	Autumn	N. 22° W.	5.7	N. 15° W.	7.0	N. 15° W.	8.3	N. 15° W.	8.6	N. 11° E.	12.8	N.					
	Winter	N. 22° W.	7.6	N. 14° W.	11.0	N. 18° W.	11.4	N. 18° W.	11.0	N. 38° W.	15.5	N. 22° W.	21.5				
	Annual	N. 22° W.	6.4	N. 17° W.	8.2	N. 20° W.	8.8	N. 24° W.	9.0	N. 25° W.	12.6	N. 24° W.	16.3	N. 45° W.	16.0		
Means	Spring	S. 21° W.	7.2	S. 46° W.	10.3	S. 54° W.	11.8	S. 61° W.	12.2	S. 86° W.	13.3	N. 84° W.	14.3	N. 84° W.	15.9	N. 45° W.	19.9
	Summer	S. 55° W.	5.0	S. 62° W.	7.5	S. 68° W.	8.3	S. 77° W.	8.4	S. 83° W.	9.2	S. 86° W.	10.6	S. 88° W.	12.8		
	Autumn	S. 47° W.	5.3	S. 56° W.	8.4	S. 62° W.	9.7	S. 70° W.	10.1	S. 78° W.	11.5	S. 80° W.	12.6	N. 89° W.	13.9		
	Winter	S. 54° W.	6.2	S. 64° W.	9.8	S. 69° W.	11.4	S. 78° W.	12.0	S. 84° W.	14.9	S. 83° W.	17.6	S. 68° W.	19.5		
	Annual	S. 44° W.	5.9	S. 57° W.	9.0	S. 63° W.	10.3	S. 72° W.	10.7	S. 83° W.	12.2	S. 86° W.	13.8	S. 86° W.	15.5	N. 45° W.	18.0

TABLE 10a.—*Average deviation, degrees, of free-air winds from surface direction at three northern stations—Drexel, Ellendale, and Royal Center.*

[Plus sign indicates turning to right; minus sign, to left.]

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).					
	500	750	1,000	2,000	3,000	4,000
N	+2	+6	+6	−6	−25	−52
NNE	0	+1	−1	−18	−36	−34
NE	+1	+5	+10	−6	−60	−49
ENE	+3	+5	+13	+27	−69	−102
E	+4	+11	+14	+29	+82	+146
ESE	+3	+12	+21	+52	+99	.....
SE	+8	+15	+26	+54	+88	+110
SSE	+4	+11	+15	+48	+78	+64
S	+5	+12	+18	+28	+40	+52
SSW	+5	+10	+17	+28	+46	+45
SW	+3	+8	+11	+27	+36	+45
WSW	0	+3	+5	+20	+25	0
W	+1	+5	+9	+9	−2	+11
WNW	+2	+7	+5	−1	+3	+8
NW	+1	+3	+1	−1	−12	−29
NNW	+1	−1	−1	−17	−22	−33

Winter.

N	+16	+19	+21	−8	−40	−48
NNE	+1	+5	+5	−21	−53	.....
NE	0	+8	+13	+13	−30	.....
ENE	+1	+15	+21	+57	+74	.....
E	+9	+21	+28	+43	+87	+112
ESE	+5	+20	+36	+87	+117	+150
SE	+13	+33	+42	+88	+111	+120
SSE	+8	+29	+43	+77	+96	+93
S	+8	+21	+33	+64	+81	+85
SSW	+7	+20	+32	+53	+60	+71
SW	+7	+20	+30	+48	+48	+45
WSW	+5	+16	+24	+33	+33	+42
W	+6	+16	+21	+26	+23	+13
WNW	0	+5	+8	+6	−1	−9
NW	+1	+4	+5	−7	−15	−22
NNW	+3	+3	+2	−12	−17	−52

Annual.

N	+4	+6	+8	−8	−26	−40
NNE	+1	+3	+4	−12	−32	−54
NE	+1	+6	+9	−1	−53	−40
ENE	+1	+7	+14	+27	+31	+64
E	+5	+13	+19	+34	+66	+79
ESE	+5	+17	+27	+59	+95	+118
SE	+8	+20	+28	+61	+86	+106
SSE	+6	+16	+24	+50	+71	+70
S	+7	+15	+23	+40	+55	+67
SSW	+6	+14	+22	+36	+49	+60
SW	+4	+12	+17	+32	+43	+47
WSW	+2	+10	+15	+25	+31	+33
W	+2	+10	+14	+16	+10	+12
WNW	+1	+6	+8	+4	−3	−4
NW	+1	+4	+4	−4	−14	−31
NNW	+2	+2	0	−6	−14	−27

[1] Average surface altitude, 350 m. above m. s. l.

TABLE 10b.—*Average deviation, degrees, of free-air winds from surface direction at three southern stations—Broken Arrow, Groesbeck, and Leesburg.*

[Plus sign indicates turning to right; minus sign, to left.]

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).					
	500	750	1,000	2,000	3,000	4,000
N	+4	+8	+6	0	.....	.....
NNE	+12	+14	+22	0	.....	.....
NE	+4	+3	+3	−9	.....	.....
ENE	+8	+9	+10	+16	+11	+22
E	+11	+13	+19	+25	+7	.....
ESE	+16	+24	+32	+55	+58	.....
SE	+9	+19	+27	+35	+52	+135
SSE	+4	+6	+11	+20	+27	+16
S	+4	+8	+16	+24	+38	+102
SSW	+3	+2	+6	+7	+4	−11
SW	−3	−2	−5	−12	−4	.....
WSW	−4	6	+18	+28	+30	−23
W	−1	−2	−2	−8	−7	−34
WNW	+8	+15	+25	+27	0	.....
NW	−23	−11	−45	−23	−23	.....
NNW	+4	+4	+4	−27	−34	−68

Winter.

N	+4	+6	+7	−22	−45	−45
NNE	+12	+16	+18	+5	−28	−90
NE	+10	+16	+23	−75	−90	.....
ENE	−4	−5	−15	−14	0	.....
E	+40	+52	+86	.....	.....	.....
ESE	+7	+30	+38	+70	+82	+98
SE	+26	+42	+42	+66	+90	.....
SSE	+25	+30	+44	+50	+71	+67
S	+7	+16	+23	+39	+54	+113
SSW	+10	+16	+19	+38	+37	+62
SW	+12	+15	+23	+42	+57	+66
WSW	+3	+4	+11	+24	+62	+22
W	+3	+11	+11	+11	+11	+45
WNW	+10	+11	+18	+17	+11	−22
NW	0	+1	0	−8	−19	−23
NNW	+1	−1	−1	−19	−29	−12

Annual.

N	+2	+6	+6	−18	−33	−32
NNE	+7	+8	+8	+9	−45	−61
NE	+4	+8	+10	−23	−19	−6
ENE	+4	+9	+9	+16	−21	+22
E	+18	+24	+31	+44	+58	.....
ESE	+10	+24	+32	+60	+75	+115
SE	+12	+22	+31	+47	+65	+105
SSE	+12	+18	+27	+44	+64	+62
S	+5	+11	+16	+32	+46	+66
SSW	+4	+8	+11	+22	+25	+28
SW	+4	+6	+9	+21	+29	+51
WSW	−1	0	+5	+8	+26	+9
W	+1	+6	+10	+9	+9	+6
WNW	+5	+7	+14	+13	+2	−22
NW	−2	0	−6	−8	−12	−8
NNW	−1	0	0	−21	−28	−36

[1] Average surface altitude, 150 m. above m. s. l.

TABLE 10c.—*Average deviations, degrees, of free-air winds from surface direction at all six stations.*

[Plus sign indicates turning to right; minus sign, to left.]

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).					
	500	750	1,000	2,000	3,000	4,000
N	+3	+7	+6	−5	−25	−52
NNE	+5	+6	+8	−14	−36	−34
NE	+2	+4	+6	−8	−60	−49
ENE	+5	+7	+12	+24	−42	−85
E	+8	+12	+16	+27	+64	+146
ESE	+10	+18	+26	+53	+78	.....
SE	+8	+17	+27	+44	+74	+118
SSE	+4	+9	+13	+37	+58	+40
S	+5	+10	+14	+26	+39	+76
SSW	+4	+6	+12	+18	+25	+31
SW	0	+3	+3	+11	+20	+45
WSW	−2	+2	+12	+24	+28	−8
W	0	+3	+5	+2	−3	0
WNW	+5	+11	+15	+13	+2	+8
NW	−5	−1	−10	−6	−15	−29
NNW	+3	+1	+1	−21	−25	−45

Winter.

N	+10	+12	+14	−15	−43	−46
NNE	+6	+10	+10	−8	−40	−90
NE	+5	+12	+18	−31	−45	.....
ENE	−1	+ 7	+6	+39	+49	.....
E	+21	+34	+51	+43	+87	+112
ESE	+6	+25	+37	+80	+108	+132
SE	+18	+36	+42	+76	+106	+120
SSE	+16	+30	+44	+63	+84	+84
S	+8	+18	+28	+51	+67	+74
SSW	+8	+18	+26	+45	+48	+68
SW	+10	+18	+26	+45	+52	+58
WSW	+4	+10	+17	+29	+45	+36
W	+4	+14	+16	+18	+17	+21
WNW	+5	+8	+13	+11	+5	−12
NW	0	+3	+2	−8	−17	−22
NNW	+2	+1	0	−16	−23	−32

Annual.

N	+3	+6	+7	−13	−29	−36
NNE	+4	+6	+6	−2	−39	−56
NE	+3	+7	+9	−12	−36	−23
ENE	+3	+8	+12	+22	+10	+50
E	+12	+18	+25	+39	+43	+79
ESE	+8	+20	+30	+60	+85	+116
SE	+10	+21	+29	+54	+76	+106
SSE	+9	+17	+26	+47	+67	+66
S	+6	+13	+20	+36	+51	+67
SSW	+5	+11	+16	+29	+37	+44
SW	+4	+9	+13	+26	+36	+49
WSW	+1	+5	+10	+17	+28	+19
W	+2	+8	+12	+12	+10	+10
WNW	+3	+6	+11	+9	0	−11
NW	−1	+2	−1	−6	−13	−19
NNW	0	+1	0	−14	−21	−32

[1] Average surface altitude, 250 m. above m. s. l.

TABLE 11a.—*Average increase, m. p. s., of free-air wind velocities above surface velocity at three northern stations—Drexel, Ellendale, and Royal Center.*

[Minus sign indicates decrease.]

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).					
	500	750	1,000	2,000	3,000	4,000
N	2.0	4.4	4.6	4.1	5.5	9.2
NNE	1.0	2.8	2.9	2.8	1.5	2.0
NE	1.8	3.6	3.2	2.4	3.4	4.0
ENE	2.2	3.3	2.7	1.7	0.4	2.5
E	1.3	2.9	2.3	−0.3	−0.6	1.2
ESE	1.5	3.2	3.4	1.7	1.9	.....
SE	1.5	3.2	3.4	2.1	4.4	3.2
SSE	1.8	3.9	4.4	4.7	4.5	3.6
S	2.3	5.2	5.5	4.6	6.0	3.1
SSW	1.9	4.3	4.9	5.3	5.9	6.3
SW	2.1	4.0	4.8	4.6	6.6	8.3
WSW	1.8	4.2	4.9	5.6	7.0	8.1
W	1.8	3.9	4.7	6.8	10.6	13.3
WNW	1.8	4.6	5.3	6.9	9.1	11.2
NW	1.4	3.6	4.3	7.0	8.8	12.0
NNW	1.0	2.7	3.1	4.1	6.1	9.0
Means	1.8	4.0	4.3	4.3	5.0	6.4

Winter.

N	1.4	3.1	3.4	2.8	4.8	6.6
NNE	1.1	2.3	2.9	3.8	5.8	.....
NE	0.6	1.4	1.8	−0.3	−0.7	.....
ENE	1.1	1.9	1.7	0.0	2.6	.....
E	1.7	4.0	4.1	3.2	2.3	7.7
ESE	2.8	4.3	4.0	5.3	6.9	10.4
SE	2.4	5.3	5.9	8.7	10.4	16.0
SSE	3.3	7.0	7.8	8.2	9.4	14.4
S	3.3	6.6	7.7	8.6	10.8	12.7
SSW	3.1	6.7	7.4	8.6	12.0	15.8
SW	2.7	6.4	7.2	10.7	13.3	15.2
WSW	2.1	5.1	6.6	10.1	12.9	16.4
W	2.1	5.6	7.1	10.5	13.2	15.9
WNW	1.9	5.4	7.0	10.1	13.0	15.7
NW	2.1	5.1	6.4	9.4	13.4	13.6
NNW	2.0	4.2	4.8	7.7	11.3	12.6
Means	2.2	4.9	5.8	7.9	10.3	12.8

Annual.

N	1.7	3.7	4.0	3.8	5.3	8.2
NNE	1.0	2.7	2.9	2.9	3.3	4.7
NE	1.2	2.7	2.7	1.1	2.2	3.6
ENE	1.8	3.0	2.7	1.5	0.4	0.4
E	1.5	3.3	3.1	1.4	1.2	1.5
ESE	1.9	3.5	3.6	3.0	3.9	6.6
SE	2.2	4.2	5.0	5.3	7.5	8.4
SSE	2.6	5.5	6.2	6.3	6.6	8.8
S	2.6	5.6	6.3	6.3	7.7	9.3
SSW	2.5	5.5	6.4	6.9	8.3	10.0
SW	2.5	5.6	6.3	7.6	9.5	11.7
WSW	2.0	4.7	5.6	7.8	10.1	12.4
W	1.8	4.3	5.3	7.8	11.0	13.5
WNW	1.6	4.0	5.3	8.1	11.0	13.8
NW	1.4	3.8	4.6	7.5	9.8	13.4
NNW	1.3	3.6	4.3	6.3	8.9	10.5
Means	2.0	4.5	5.1	5.9	7.4	9.3

[1] Average surface altitude, 350 m. above m. s. l.

TABLE 11b.—*Average increase, m. p. s., of free-air wind velocities above surface velocity at three southern stations—Broken Arrow, Groesbeck, and Leesburg.*

[Minus sign indicates decrease.]

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).					
	500	750	1,000	2,000	3,000	4,000
N	2.2	1.5	−0.1	0.0		
NNE	0.8	0.4	0.2	−2.2		
NE	1.2	1.9	1.8	1.1		
ENE	1.9	2.8	2.2	2.5	5.7	4.7
E	3.9	4.9	4.8	4.3	2.8	
ESE	3.1	3.8	3.7	3.0	3.2	
SE	2.7	3.7	4.0	3.8	6.3	4.6
SSE	2.1	2.8	2.9	1.2	1.2	2.0
S	2.6	2.7	2.2	1.8	0.9	2.0
SSW	3.1	3.7	4.0	2.3	0.5	1.1
SW	3.2	3.7	3.4	0.4	−0.2	
WSW	2.5	2.9	3.2	3.8	3.3	5.0
W	2.0	3.0	4.4	6.9	6.6	5.6
WNW	2.0	1.8	1.8	1.8		
NW	0.5	0.5	0.5	1.5	1.5	
NNW	2.3	2.4	1.8	2.6	4.9	6.9
Means	2.8	3.3	3.3	2.3	1.7	1.8

Winter.

N	3.1	3.4	3.9	5.6	8.7	10.6
NNE	2.5	2.6	2.3	1.0	3.2	
NE	3.5	4.3	3.5	3.6	1.0	
ENE	2.5	1.7	0.4	−0.1	−1.1	
E	4.2	4.4	4.0			
ESE	3.5	3.8	6.2	4.2	9.0	8.5
SE	6.2	8.0	8.7	7.8	5.3	
SSE	6.8	8.6	8.7	6.9	6.0	4.9
S	6.3	8.0	8.9	8.4	9.5	12.3
SSW	6.1	7.6	7.8	9.4	10.1	10.2
SW	5.5	6.1	6.5	8.2	9.5	10.5
WSW	6.0	6.8	7.1	5.6	10.0	11.0
W	3.8	4.9	6.0	9.8	12.2	16.8
WNW	3.6	5.3	6.5	10.9	13.8	
NW	3.2	4.6	5.9	9.2	13.0	15.9
NNW	2.8	3.2	3.9	6.7	10.7	13.2
Means	4.4	5.4	5.9	6.9	8.9	10.8

Annual.

N	2.4	2.4	2.1	2.5	5.2	8.9
NNE	1.7	1.9	1.7	0.5	1.6	4.8
NE	2.6	2.9	2.3	1.8	3.5	8.4
ENE	2.6	2.9	2.2	−1.0	0.5	2.9
E	3.8	4.2	4.1	2.3	1.5	
ESE	3.6	4.1	4.1	2.6	2.5	2.8
SE	4.6	5.5	5.6	5.4	6.3	7.7
SSE	5.2	6.3	6.3	5.0	4.2	4.9
S	5.2	6.3	6.5	5.5	6.4	8.0
SSW	4.3	5.4	5.6	5.6	5.9	7.2
SW	4.5	4.9	5.0	5.3	6.5	8.7
WSW	3.6	4.1	4.3	5.8	6.6	10.0
W	3.5	4.3	5.1	8.4	11.0	13.8
WNW	3.6	5.0	6.0	8.2	12.8	14.5
NW	2.7	3.7	4.4	6.9	9.7	11.7
NNW	3.0	3.6	4.0	6.8	9.3	11.5
Means	3.7	4.5	4.6	4.6	5.6	6.8

[1] Average surface altitude, 150 m. above m. s. l.

TABLE 11c.—*Average increase, m. p. s., of free-air wind velocities above surface velocity at all six stations.*

[Minus sign indicates decrease.]

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).					
	500	750	1,000	2,000	3,000	4,000
N	2.1	3.0	2.2	3.0	5.5	9.2
NNE	0.9	1.9	1.8	1.0	1.5	2.0
NE	1.5	2.7	2.5	1.8	3.4	4.0
ENE	2.1	3.1	2.5	1.9	2.2	3.6
E	2.6	3.9	3.6	2.0	0.5	1.2
ESE	2.3	3.5	3.5	2.3	2.5	
SE	2.1	3.5	3.7	3.0	5.1	3.7
SSE	1.9	3.4	3.8	3.3	3.2	2.8
S	2.5	3.9	3.8	3.5	3.9	2.6
SSW	2.5	4.0	4.4	3.8	3.2	5.0
SW	2.6	3.8	4.1	2.9	3.9	8.3
WSW	2.1	3.6	4.0	4.7	5.2	6.6
W	1.8	3.6	4.6	6.9	9.6	11.4
WNW	1.9	3.4	3.9	4.8	9.1	11.2
NW	1.2	2.8	3.3	5.6	7.0	12.0
NNW	1.5	2.6	2.6	3.5	5.8	8.3
Means	2.3	3.7	3.8	3.3	3.3	4.1

Winter.

N	2.2	3.3	3.6	4.2	7.1	8.6
NNE	1.8	2.4	2.6	2.4	4.5	8.7
NE	2.0	2.9	2.6	1.6	−0.3	
ENE	1.6	1.8	1.2	−0.1	1.3	
E	2.7	4.1	4.1	3.2	2.3	7.7
ESE	3.1	4.0	4.9	4.9	7.4	9.8
SE	4.0	6.4	7.0	8.3	9.2	16.0
SSE	5.1	7.8	8.2	7.5	7.7	11.2
S	4.8	5.6	8.3	8.5	10.2	12.5
SSW	4.6	7.2	7.6	9.0	11.0	9.5
SW	4.1	6.2	6.8	9.4	11.4	12.4
WSW	4.0	6.0	6.9	8.3	12.2	14.6
W	3.0	5.2	6.6	10.1	12.7	16.1
WNW	2.7	5.3	6.8	10.5	13.4	15.7
NW	2.6	4.9	6.2	9.3	13.2	14.8
NNW	2.4	3.4	4.4	7.2	11.0	12.9
Means	3.3	5.2	5.8	7.4	9.6	11.8

Annual.

N	2.1	3.0	3.0	3.2	5.2	8.6
NNE	1.4	2.3	2.3	1.7	2.5	4.8
NE	1.9	2.8	2.5	1.4	2.8	5.2
ENE	2.2	3.0	2.4	0.2	0.4	1.2
E	2.6	3.8	3.6	1.8	1.3	1.5
ESE	2.8	3.8	3.9	2.8	3.2	4.3
SE	3.6	4.8	5.3	5.3	6.9	8.0
SSE	3.9	5.9	6.2	5.7	5.6	6.9
S	3.9	6.0	6.4	5.9	7.0	8.6
SSW	3.4	5.4	6.0	6.2	7.1	8.6
SW	3.5	5.2	5.7	6.5	8.0	10.2
WSW	2.8	4.4	5.0	6.8	8.4	11.5
W	2.6	4.3	5.2	8.1	11.0	13.6
WNW	2.6	4.5	5.6	8.1	11.9	14.0
NW	2.1	3.8	4.5	7.2	9.8	12.6
NNW	2.2	3.6	4.1	6.6	9.1	11.0
Means	2.8	4.5	4.9	5.3	6.5	8.1

[1] Average surface altitude, 250 m. above m. s. l.

TABLE 12a.—*Average free-air winds, m. p. s., for different surface directions at three northern stations—Drexel, Ellendale, and Royal Center.*

[Based on Tables 10a and 11a.]

Summer.

Surface.[1]		Altitude above m. s. l. (meters.)											
		500		750		1,000		2,000		3,000		4,000	
Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
N	5.4	N. 2° E.	7.4	N. 6° E.	9.8	N. 6° E.	10.0	N. 6° W.	9.5	N. 25° W.	10.9	N. 52° W.	14.6
NNE	5.4	N. 22° E.	6.4	N. 23° E.	8.2	N. 21° E.	8.3	N. 4° E.	8.2	N. 14° W.	6.9	N. 12° W.	7.4
NE	4.4	N. 46° E.	6.2	N. 50° E.	8.0	N. 55° E.	7.6	N. 39° E.	6.8	N. 15° W.	7.8	N. 4° W.	8.4
ENE	5.1	N. 71° E.	7.3	N. 73° E.	8.4	N. 81° E.	7.8	S. 85° E.	6.8	N. 1° E.	5.5	S. 56° W.	7.6
E	4.7	S. 86° E.	6.0	S. 79° E.	7.6	S. 76° E.	7.0	S. 61° E.	4.4	S. 8° E.	4.1	S. 56° W.	5.9
ESE	5.4	S. 65° E.	6.9	S. 56° E.	8.6	S. 47° E.	8.8	S. 16° E.	7.1	S. 21° W.	7.3	.....	.....
SE	5.4	S. 37° E.	6.9	S. 30° E.	8.6	S. 19° E.	8.8	S. 9° W.	7.5	S. 43° W.	9.8	S. 63° W.	8.6
SSE	5.0	S. 18° E.	6.8	S. 11° E.	8.9	S. 7° E.	9.4	S. 26° W.	9.7	S. 56° W.	9.5	S. 42° W.	8.6
S	5.2	S. 5° W.	7.5	S. 12° W.	10.4	S. 18° W.	10.7	S. 28° W.	9.8	S. 40° W.	11.2	S. 52° W.	8.3
SSW	5.7	S. 27° W.	7.6	S. 32° W.	10.0	S. 39° W.	10.6	S. 50° W.	11.0	S. 68° W.	11.6	S. 67° W.	12.0
SW	5.8	S. 48° W.	7.9	S. 53° W.	9.8	S. 56° W.	10.6	S. 72° W.	10.4	S. 81° W.	12.4	W.	14.1
WSW	5.1	S. 68° W.	6.9	S. 71° W.	9.3	S. 73° W.	10.0	S. 88° W.	10.7	N. 87° W.	12.1	S. 68° W.	13.2
W	5.8	N. 89° W.	7.6	N. 85° W.	9.7	N. 81° W.	10.5	N. 81° W.	12.6	S. 88° W.	16.4	N. 79° W.	19.1
WNW	5.3	N. 66° W.	7.1	N. 61° W.	9.9	N. 63° W.	10.6	N. 60° W.	12.2	N. 65° W.	14.4	N. 60° W.	16.5
NW	5.8	N. 44° W.	7.2	N. 42° W.	9.4	N. 44° W.	10.1	N. 46° W.	12.8	N. 57° W.	14.6	N. 74° W.	17.8
NNW	5.9	N. 21° W.	6.9	N. 23° W.	8.6	N. 23° W.	9.0	N. 39° W.	10.0	N. 44° W.	12.0	N. 55° W.	14.9
Means	5.5	.....	7.3	.....	9.5	.....	9.8	.....	9.8	.....	10.5	.....	11.9

Winter.

N	5.9	N. 16° E.	7.3	N. 19° E.	9.0	N. 21° E.	9.3	N. 8° W.	8.7	N. 40° W.	10.7	N. 48° W.	12.5
NNE	6.0	N. 23° E.	7.1	N. 27° E.	8.3	N. 27° E.	8.9	N. 1° E.	9.8	N. 31° W.	11.8	.....	.....
NE	6.6	N. 45° E.	7.2	N. 53° E.	8.0	N. 58° E.	8.4	N. 58° E.	6.3	N. 15° E.	5.9	.....	.....
ENE	6.1	N. 69° E.	7.2	N. 83° E.	8.0	N. 89° E.	7.8	S. 55° E.	6.1	S. 38° E.	8.7	.....	.....
E	6.2	S. 81° E.	7.9	S. 69° E.	10.2	S. 62° E.	10.3	S. 47° E.	9.4	S. 3° E.	8.5	S. 22° W.	13.9
ESE	5.5	S. 63° E.	8.3	S. 48° E.	9.8	S. 32° E.	9.5	S. 19° W.	10.8	S. 49° W.	12.4	S. 82° W.	15.9
SE	5.8	S. 32° E.	8.2	S. 12° E.	11.1	S. 3° E.	11.7	S. 43° W.	14.5	S. 66° W.	16.2	S. 75° W.	21.8
SSE	5.3	S. 14° E.	8.6	S. 7° W.	12.3	S. 21° W.	13.1	S. 55° W.	13.5	S. 74° W.	14.7	S. 71° W.	19.7
S	5.3	S. 8° W.	8.6	S. 21° W.	11.9	S. 33° W.	13.0	S. 64° W.	13.9	S. 81° W.	16.1	S. 85° W.	18.0
SSW	6.1	S. 29° W.	9.2	S. 42° W.	12.8	S. 54° W.	13.5	S. 75° W.	14.7	S. 82° W.	18.1	N. 87° W.	21.9
SW	6.2	S. 52° W.	8.9	S. 65° W.	12.6	S. 75° W.	13.4	N. 87° W.	16.9	N. 87° W.	19.5	W.	21.4
WSW	5.5	S. 73° W.	7.6	S. 84° W.	10.6	N. 88° W.	12.1	N. 79° W.	15.6	N. 79° W.	18.4	N. 70° W.	21.9
W	6.4	N. 84° W.	8.5	N. 74° W.	12.0	N. 69° W.	13.5	N. 64° W.	16.9	N. 67° W.	19.6	N. 77° W.	22.3
WNW	6.0	N. 68° W.	7.9	N. 63° W.	11.4	N. 60° W.	13.0	N. 62° W.	16.1	N. 69° W.	19.0	N. 78° W.	21.7
NW	6.9	N. 44° W.	9.0	N. 41° W.	12.0	N. 40° W.	13.3	N. 52° W.	16.3	N. 60° W.	20.3	N. 67° W.	20.5
NNW	7.6	N. 19° W.	9.6	N. 19° W.	11.8	N. 20° W.	12.4	N. 34° W.	15.3	N. 39° W.	18.9	N. 74° W.	20.2
Means	6.4	.....	8.6	.....	11.3	.....	12.2	.....	14.3	.....	16.7	.....	19.2

Annual.

N	5.7	N. 4° E.	7.4	N. 6° E.	9.4	N. 8° E.	9.7	N. 8° W.	11.5	N. 26° W.	11.0	N. 40° W.	13.9
NNE	5.9	N. 23° E.	6.9	N. 25° E.	8.6	N. 26° E.	8.8	N. 10° E.	8.8	N. 10° W.	9.2	N. 32° W.	10.6
NE	5.8	N. 46° E.	7.0	N. 51° E.	8.5	N. 54° E.	8.5	N. 44° E.	6.9	N. 8° W.	8.0	N. 5° E.	9.4
ENE	5.6	N. 69° E.	7.4	N. 75° E.	8.6	N. 82° E.	8.3	S. 85° E.	7.1	S. 81° E.	6.0	S. 48° E.	6.0
E	6.0	S. 85° E.	7.5	S. 77° E.	9.3	S. 71° E.	9.1	S. 56° E.	7.4	S. 24° E.	7.2	S. 11° E.	7.5
ESE	5.7	S. 63° E.	7.6	S. 51° E.	9.2	S. 41° E.	9.3	S. 9° E.	8.7	S. 27° W.	9.6	S. 50° W.	12.3
SE	5.8	S. 37° E.	8.0	S. 25° E.	10.0	S. 17° E.	10.8	S. 16° W.	11.1	S. 41° W.	13.3	S. 61° W.	14.2
SSE	5.8	S. 16° E.	8.4	S. 6° E.	11.3	S. 2° W.	12.0	S. 28° W.	12.1	S. 49° W.	12.4	S. 48° W.	14.6
S	6.0	S. 7° W.	8.6	S. 15° W.	11.6	S. 23° W.	12.3	S. 40° W.	12.3	S. 55° W.	13.7	S. 67° W.	15.3
SSW	6.2	S. 28° W.	8.7	S. 36° W.	11.7	S. 44° W.	12.6	S. 58° W.	13.1	S. 71° W.	14.5	S. 82° W.	16.2
SW	6.4	S. 49° W.	8.9	S. 57° W.	12.0	S. 62° W.	12.7	S. 77° W.	14.0	S. 88° W.	15.9	N. 88° W.	18.1
WSW	5.8	S. 70° W.	7.8	S. 78° W.	10.5	S. 83° W.	11.4	N. 87° W.	13.6	N. 81° W.	15.9	N. 79° W.	18.2
W	6.3	N. 88° W.	8.1	N. 80° W.	10.6	N. 76° W.	11.6	N. 74° W.	14.1	N. 80° W.	17.3	N. 78° W.	19.8
WNW	6.3	N. 67° W.	7.9	N. 62° W.	10.3	N. 60° W.	11.6	N. 64° W.	14.4	N. 71° W.	17.3	N. 72° W.	20.1
NW	6.8	N. 44° W.	8.2	N. 41° W.	10.6	N. 41° W.	11.4	N. 49° W.	14.3	N. 59° W.	16.6	N. 76° W.	20.2
NNW	6.8	N. 20° W.	8.1	N. 20° W.	10.4	N. 22° W.	11.1	N. 28° W.	13.1	N. 36° W.	15.7	N. 49° W.	17.3
Means	6.3	.....	8.3	.....	10.8	.....	11.4	.....	12.2	.....	13.7	.....	15.6

[1] Average surface altitude, 350 m. above m. s. l.

TABLE 12b.—*Average free-air winds, m. p. s. for different surface directions at three southern stations—Broken Arrow, Groesbeck, and Leesburg.*

[Based on Tables 10b and 11b.]

Summer.

Surface.[1]		Altitude above m. s. l. (meters).											
		500		750		1,000		2,000		3,000		4,000	
Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
N	4.5	N. 4° E.	6.7	N. 8° E.	5.0	N. 6° E.	4.4	N.	4.5				
NNE	5.9	N. 34° E.	6.7	N. 36° E.	6.3	N. 44° E.	6.1	N. 22° E.	3.7				
NE	6.0	N. 49° E.	7.2	N. 48° E.	7.9	N. 48° E.	7.8	N. 36° E.	7.1				
ENE	8.0	N. 76° E.	9.9	N. 77° E.	10.8	N. 78° E.	10.2	N. 84° E.	10.5	N. 79° E.	13.7	E.	12.7
E	4.4	S. 79° E.	8.2	S. 77° E.	9.3	S. 71° E.	9.2	S. 65° E.	8.7	S. 83° E.	7.2		
ESE	4.3	S. 52° E.	7.4	S. 44° E.	8.1	S. 36° E.	8.0	S. 13° E.	7.3	S. 10° E.	7.5		
SE	5.5	S. 36° E.	8.2	S. 26° E.	9.2	S. 18° E.	9.5	S. 10° E.	9.3	S. 7° W.	11.8	W.	10.1
SSE	5.8	S. 18° E.	7.9	S. 16° E.	8.6	S. 11° E.	8.7	S. 2° E.	7.0	S. 5° W.	7.0	S. 6° E.	7.8
S	5.6	S. 4° W.	8.2	S. 8° W.	8.3	S. 16° W.	7.8	S. 24° W.	7.4	S. 38° W.	6.5	N. 78° W.	7.6
SSW	5.3	S. 25° W.	8.4	S. 24° W.	9.0	S. 28° W.	9.3	S. 29° W.	7.6	S. 26° W.	5.8	S. 11° W.	6.4
SW	5.7	S. 42° W.	8.9	S. 43° W.	9.4	S. 40° W.	9.1	S. 33° W.	6.1	S. 41° W.	5.5		
WSW	4.6	S. 64° W.	7.1	S. 68° W.	7.5	S. 86° W.	7.8	N. 84° W.	8.4	N. 82° W.	7.9	S. 45° W.	9.6
W	5.6	S. 89° W.	7.6	S. 88° W.	8.6	S. 88° W.	10.0	S. 82° W.	12.5	S. 83° W.	12.2	S. 56° W.	11.2
WNW	5.0	N. 60° W.	7.0	N. 53° W.	6.8	N. 43° W.	5.8	N. 41° W.	6.8	N. 68° W.			
NW	5.5	N. 68° W.	6.0	N. 56° W.	6.0	W.	6.0	N. 68° W.	7.0	N. 68° W.	7.0		
NNW	6.8	N. 18° W.	9.1	N. 18° W.	9.2	N. 18° W.	8.2	N. 49° W.	9.4	N. 56° W.	11.7	W.	13.7
Means	5.5		8.3		8.8		8.8		7.8		7.2		7.3

Winter.

N	6.5	N. 4° E.	9.6	N. 6° E.	9.9	N. 7° E.	10.4	N. 22° W.	12.1	N. 45° W.	15.2	N. 45° W.	17.1
NNE	6.2	N. 34° E.	8.7	N. 38° E.	8.8	N. 40° E.	8.5	N. 27° E.	7.2	N. 8° W.	9.4	N. 68° W.	
NE	5.0	N. 55° E.	8.5	N. 61° E.	9.3	N. 68° E.	8.5	N. 30° W.	8.6	N. 45° W.	6.0		
ENE	4.6	N. 64° E.	7.1	N. 63° E.	6.3	N. 53° E.	5.0	N. 54° E.	4.5	N. 68° E.	3.5		
E	3.1	S. 50° E.	7.3	S. 38° E.	7.5	S. 4° E.	7.1						
ESE	3.9	S. 61° E.	7.4	S. 38° E.	7.7	S. 39° E.	10.1	S. 2° W.	8.1	S. 14° W.	12.9	S. 30° W.	12.4
SE	5.6	S. 19° E.	11.8	S. 3° E.	13.6	S. 3° E.	14.3	S. 11° W.	13.4	S. 45° W.	10.9		
SSE	5.5	S. 3° W.	12.3	S. 8° W.	14.1	S. 22° W.	14.3	S. 28° W.	12.4	S. 49° W.	11.5	S. 45° W.	10.4
S	6.3	S. 7° W.	12.6	S. 16° W.	14.3	S. 23° W.	15.2	S. 39° W.	14.7	S. 54° W.	15.8	N. 67° W.	18.6
SSW	6.3	S. 32° W.	12.4	S. 38° W.	13.9	S. 41° W.	14.1	S. 60° W.	15.7	S. 59° W.	16.4	S. 84° W.	16.5
SW	4.9	S. 57° W.	10.4	S. 60° W.	11.0	S. 68° W.	11.4	S. 87° W.	13.1	N. 78° W.	14.4	N. 69° W.	15.4
WSW	5.9	S. 71° W.	11.9	S. 72° W.	12.7	S. 79° W.	13.0	N. 88° W.	11.5	N. 50° W.	15.9	N. 68° W.	16.9
W	5.5	N. 87° W.	9.3	N. 79° W.	10.4	N. 79° W.	11.5	N. 79° W.	15.3	N. 79° W.	17.7	N. 45° W.	22.3
WNW	7.2	N. 58° W.	10.8	N. 57° W.	12.5	N. 50° W.	13.7	N. 51° W.	18.1	N. 57° W.	21.0	W.	
NW	7.0	N. 45° W.	10.2	N. 44° W.	11.6	N. 45° W.	12.9	N. 53° W.	16.2	N. 64° W.	20.0	N. 68° W.	22.9
NNW	6.7	N. 21° W.	9.5	N. 23° W.	9.9	N. 23° W.	10.6	N. 41° W.	13.4	N. 51° W.	17.4	N. 34° W.	19.9
Means	6.2		10.6		11.6		12.1		13.1		15.1		17.0

Annual.

N	6.7	N. 2° E.	9.1	N. 6° E.	9.1	N. 6° E.	8.8	N. 18° W.	9.2	N. 33° W.	11.9	N. 32° W.	15.6
NNE	5.7	N. 29° E.	7.4	N. 30° E.	7.6	N. 30° E.	7.4	N. 31° E.	6.2	N. 23° W.	7.3	N. 39° W.	10.5
NE	5.5	N. 49° E.	8.1	N. 53° E.	8.4	N. 55° E.	7.8	N. 22° E.	7.3	N. 26° E.	9.0	N. 39° E.	13.9
ENE	5.6	N. 72° E.	8.2	N. 77° E.	8.5	N. 77° E.	7.8	N. 84° E.	4.6	N. 47° E.	6.1	E.	8.5
E	4.3	S. 72° E.	8.1	S. 66° E.	8.5	S. 59° E.	8.4	S. 46° E.	6.6	S. 32° E.	5.8		
ESE	4.7	S. 58° E.	8.3	S. 44° E.	8.8	S. 36° E.	8.8	S. 8° E.	7.3	S. 7° W.	7.2	S. 47° W.	7.5
SE	5.4	S. 33° E.	10.0	S. 23° E.	10.9	S. 14° E.	11.0	S. 2° W.	10.8	S. 20° W.	11.7	S. 60° W.	13.1
SSE	5.5	S. 10° E.	10.7	S. 4° E.	11.8	S. 5° W.	11.8	S. 22° W.	10.5	S. 42° W.	9.7	S. 40° W.	10.4
S	6.3	S. 5° W.	11.5	S. 11° W.	12.6	S. 16° W.	12.8	S. 32° W.	11.8	S. 46° W.	12.7	S. 66° W.	14.3
SSW	6.2	S. 26° W.	10.5	S. 30° W.	11.6	S. 33° W.	11.8	S. 44° W.	11.8	S. 47° W.	12.1	S. 50° W.	13.4
SW	5.3	S. 49° W.	9.8	S. 51° W.	10.2	S. 54° W.	10.3	S. 66° W.	10.6	S. 74° W.	11.8	N. 84° W.	14.0
WSW	5.8	S. 67° W.	9.4	S. 68° W.	9.9	S. 73° W.	10.1	S. 76° W.	11.6	N. 86° W.	12.4	S. 77° W.	15.8
W	6.7	N. 89° W.	10.2	N. 84° W.	11.0	N. 80° W.	11.8	N. 81° W.	15.1	N. 81° W.	17.7	N. 84° W.	20.5
WNW	6.1	N. 63° W.	9.7	N. 61° W.	11.1	N. 54° W.	12.1	N. 55° W.	14.3	N. 66° W.	18.9	W.	20.6
NW	6.8	N. 47° W.	9.5	N. 45° W.	10.5	N. 51° W.	11.2	N. 53° W.	13.7	N. 57° W.	16.5	N. 53° W.	18.5
NNW	6.6	N. 23° W.	9.6	N. 22° W.	10.2	N. 22° W.	10.6	N. 43° W.	13.4	N. 50° W.	15.9	N. 31° W.	18.1
Means	6.0		9.7		10.5		10.6		10.6		11.6		12.8

[1] Average surface altitude, 150 m. above m. s. l.

TABLE 12c.—*Average free-air winds, m. p. s. for different surface directions at all six stations.* (Based on Tables 10c and 11c.)

Summer.

Surface.[1]		Altitude above m. s. l. (meters).											
		500		750		1,000		2,000		3,000		4,000	
Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
N	4.9	N. 3° E.	7.0	N. 7° E.	7.9	N. 6° E.	7.1	N. 5° W.	7.9	N. 25° W.	10.4	N. 52° W.	14.1
NNE	5.6	N. 27° E.	6.5	N. 28° E.	7.5	N. 30° E.	7.4	N. 8° E.	6.6	N. 14° W.	7.1	N. 12° W.	7.6
NE	5.3	N. 47° E.	6.8	N. 49° E.	8.0	N. 51° E.	7.8	N. 37° E.	7.1	N. 15° W.	8.7	N. 4° W.	9.3
ENE	6.3	N. 73° E.	8.4	N. 75° E.	9.4	N. 80° E.	8.8	S. 88° E.	8.2	N. 26° E.	8.5	N. 17° W.	9.9
E	4.5	S. 82° E.	7.1	S. 78° E.	8.4	S. 74° E.	8.1	S. 63° E.	6.5	S. 26° E.	5.0	S. 56° W.	5.7
ESE	4.8	S. 58° E.	7.1	S. 50° E.	8.3	S. 42° E.	8.3	S. 15° E.	7.1	S. 10° W.	7.3	.....	.....
SE	5.4	S. 37° E.	7.5	S. 28° E.	8.9	S. 18° E.	9.1	S. 1° E.	8.4	S. 29° W.	10.5	S. 73° W.	9.1
SSE	5.3	S. 18° E.	7.2	S. 13° E.	8.7	S. 9° E.	9.1	S. 15° W.	8.6	S. 36° W.	8.5	S. 18° W.	8.1
S	5.4	S. 5° W.	7.9	S. 10° W.	9.3	S. 14° W.	9.2	S. 26° W.	8.9	S. 39° W.	9.3	S. 76° W.	8.0
SSW	5.5	S. 26° W.	8.0	S. 28° W.	9.5	S. 34° W.	9.9	S. 40° W.	9.3	S. 47° W.	8.7	S. 53° W.	10.5
SW	5.8	S. 45° W.	8.4	S. 48° W.	9.6	S. 48° W.	9.9	S. 56° W.	8.7	S. 65° W.	9.7	W.	14-1
WSW	4.9	S. 66° W.	7.0	S. 70° W.	8.5	S. 80° W.	8.9	N. 88° W.	9.6	N. 84° W.	10.1	S. 60° W.	11.5
W	5.7	W.	7.5	N. 87° W.	9.3	N. 85° W.	10.3	N. 88° W.	12.6	S. 87° W.	15.3	W.	17.1
WNW	5.2	N. 63° W.	7.1	N. 57° W.	8.6	N. 53° W.	9.1	N. 55° W.	10.0	N. 66° W.	14.3	N. 60° W.	16.4
NW	5.8	N. 50° W.	7.0	N. 46° W.	8.6	N. 55° W.	9.1	N. 51° W.	11.4	N. 60° W.	12.8	N. 74° W.	17.8
NNW	6.3	N. 19° W.	7.8	N. 21° W.	8.9	N. 21° W.	8.9	N. 43° W.	9.8	N. 47° W.	12.1	N. 67° W.	14.6
Means	5.5	.....	7.8	.....	9.2	.....	9.3	.....	8.8	.....	8.8	.....	9.6

Winter.

N	6.2	N. 10° E.	8.4	N. 12° E.	9.5	N. 14° E.	9.8	N. 15° W.	10.4	N. 43° W.	13.3	N. 46° W.	14.8
NNE	6.1	N. 28° E.	7.9	N. 32° E.	8.5	N. 32° E.	8.7	N. 14° E.	8.5	N. 18° W.	10.6	N. 68° W.	14.8
NE	5.8	N. 50° E.	7.8	N. 57° E.	8.7	N. 63° E.	8.4	N. 14° E.	7.4	N.	5.5	.....	.....
ENE	5.5	N. 67° E.	7.1	N. 75° E.	7.3	N. 74° E.	6.7	S. 73° E.	5.4	S. 63° E.	6.8	.....	.....
E	5.0	S. 69° E.	7.7	S. 56° E.	9.1	S. 39° E.	9.1	S. 47° E.	8.2	S. 3° E.	7.3	S. 22° W.	12.7
ESE	4.7	S. 62° E.	7.8	S. 43° E.	8.7	S. 31° E.	9.6	S. 12° W.	9.6	S. 40° W.	13.1	S. 64° W.	15.5
SE	5.7	S. 27° E.	9.7	S. 9° E.	12.1	S. 3° E.	12.7	S. 31° W.	14.0	S. 61° W.	14.9	S. 75° W.	21.4
SSE	5.4	S. 6° E.	10.5	S. 8° W.	13.2	S. 22° W.	13.6	S. 41° W.	12.9	S. 62° W.	13.1	S. 62° W.	16.6
S	5.8	S. 8° W.	10.6	S. 18° W.	11.4	S. 28° W.	14.1	S. 51° W.	14.3	S. 67° W.	16.0	S. 74° W.	18.3
SSW	6.2	S. 30° W.	10.8	S. 40° W.	13.4	S. 48° W.	13.8	S. 67° W.	15.2	S. 70° W.	17.2	W.	15.7
SW	5.6	S. 55° W.	9.7	S. 63° W.	11.8	S. 71° W.	12.4	W.	15.0	N. 83° W.	17.0	N. 77° W.	18.0
WSW	5.7	S. 72° W.	9.7	S. 78° W.	11.7	S. 85° W.	12.6	N. 83° W.	14.0	N. 67° W.	17.9	N. 76° W.	20.3
W	6.0	N. 86° W.	9.0	N. 76° W.	11.2	N. 74° W.	12.6	N. 72° W.	16.1	N. 73° W.	18.7	N. 69° W.	22.1
WNW	6.6	N. 63° W.	9.3	N. 60° W.	11.9	N. 55° W.	13.4	N. 57° W.	17.1	N. 63° W.	20.0	N. 80° W.	22.3
NW	7.0	N. 45° W.	9.6	N. 42° W.	11.9	N. 43° W.	13.2	N. 53° W.	16.3	N. 62° W.	20.2	N. 67° W.	21.3
NNW	7.2	N. 20° W.	9.6	N. 21° W.	10.6	N. 22° W.	11.6	N. 38° W.	14.4	N. 45° W.	18.2	N. 54° W.	20.1
Means	6.3	.....	9.6	.....	11.5	.....	12.1	.....	13.7	.....	15.9	.....	18.1

Annual.

N	6.2	N. 3° E.	7.9	N. 6° E.	9.9	N. 7° E.	10.2	N. 13° W.	10.0	N. 29° W.	11.5	N. 36° W.	14.4
NNE	5.8	N. 26° E.	6.8	N. 28° E.	8.5	N. 28° E.	8.7	N. 20° E.	8.7	N. 17° W.	9.1	N. 34° W.	10.5
NE	5.7	N. 48° E.	6.9	N. 52° E.	8.4	N. 54° E.	8.4	N. 34° E.	6.8	N. 9° E.	7.9	N. 22° E.	9.3
ENE	5.6	N. 71° E.	7.4	N. 76° E.	8.6	N. 80° E.	8.3	E.	7.1	N. 78° E.	6.0	S. 62° E.	6.0
E	5.1	S. 78° E.	6.6	S. 72° E.	8.4	S. 65° E.	8.2	S. 51° E.	6.5	S. 47° E.	6.3	S. 11° E.	6.6
ESE	5.2	S. 60° E.	7.1	S. 48° E.	8.7	S. 38° E.	8.8	S. 8° E.	8.2	S. 17° W.	9.1	S. 48° W.	11.8
SE	5.6	S. 35° E.	7.8	S. 44° E.	9.8	S. 16° E.	10.6	S. 9° W.	10.9	S. 31° W.	14.1	S. 61° W.	14.0
SSE	5.6	S. 13° E.	8.2	S. 5° E.	11.1	S. 4° W.	11.8	S. 25° W.	11.9	S. 45° W.	12.2	S. 44° W.	14.4
S	6.2	S. 6° W.	8.8	S. 13° W.	11.8	S. 20° W.	12.5	S. 36° W.	12.5	S. 51° W.	13.9	S. 67° W.	15.5
SSW	6.2	S. 27° W.	8.7	S. 33° W.	11.7	S. 38° W.	12.6	S. 51° W.	13.1	S. 59° W.	14.5	S. 66° W.	16.2
SW	5.9	S. 49° W.	8.4	S. 54° W.	11.5	S. 58° W.	12.2	S. 71° W.	13.5	S. 81° W.	15.4	N. 86° W.	17.6
WSW	5.8	S. 69° W.	7.8	S. 73° W.	10.5	S. 78° W.	11.4	S. 85° W.	13.6	N. 84° W.	15.9	S. 87° W.	18.2
W	6.5	N. 88° W.	8.3	N. 82° W.	10.8	N. 78° W.	11.8	N. 78° W.	14.3	N. 80° W.	17.5	N. 80° W.	20.0
WNW	6.2	N. 65° W.	7.8	N. 62° W.	10.2	N. 57° W.	11.5	N. 59° W.	14.3	N. 68° W.	17.2	N. 79° W.	20.0
NW	6.8	N. 46° W.	8.2	N. 43° W.	10.6	N. 46° W.	11.4	N. 51° W.	14.3	N. 58° W.	16.6	N. 64° W.	20.2
NNW	6.7	N. 22° W.	8.0	N. 21° W.	10.3	N. 22° W.	11.0	N. 36° W.	13.0	N. 43° W.	15.6	N. 54° W.	17.2
Means	6.1	.....	8.1	.....	10.6	.....	11.2	.....	12.0	.....	13.5	.....	15.4

[1] Average surface altitude, 250 m. above m. s. l.

TABLE 13a.—*Average percentage frequency of free-air winds from different directions at Broken Arrow, Okla.*

Surface direction.	Season.	Altitude above m. s. l. (meters).							
		233	500	1,000	1,500	2,000	3,000	4,000	5,000
N	Spring	7	6	6	5	3	2	0	.....
	Summer	3	4	3	4	3	0	0	.....
	Autumn	11	8	5	4	6	3	0	0
	Winter	15	14	8	11	5	4	0	0
	Annual	9	8	5	5	4	2	0	0
NNE	Spring	7	7	3	2	3	0	0	.....
	Summer	4	2	2	4	4	0	0	.....
	Autumn	8	8	8	7	6	7	7	0
	Winter	9	9	9	3	5	0	0	0
	Annual	7	7	6	4	4	2	3	0
NE	Spring	5	4	2	4	4	2	0	.....
	Summer	8	6	6	4	2	0	0	.....
	Autumn	5	7	7	6	2	2	0	0
	Winter	3	4	3	4	0	0	0	0
	Annual	6	5	5	5	2	1	0	0
ENE	Spring	2	3	1	2	1	0	0	.....
	Summer	1	4	3	1	0	0	0	.....
	Autumn	[1]0	2	3	3	1	0	0	0
	Winter	0	1	3	0	2	0	0	0
	Annual	1	3	3	2	1	0	0	0
E	Spring	2	1	3	3	3	2	0	.....
	Summer	2	1	2	1	2	0	0	.....
	Autumn	[1]0	0	1	0	1	0	0	0
	Winter	0	0	0	2	0	0	0	0
	Annual	1	[1]0	1	1	2	1	0	0
ESE	Spring	2	4	5	2	2	0	0	.....
	Summer	1	0	1	1	0	0	0	.....
	Autumn	[1]0	1	0	1	0	0	0	0
	Winter	1	1	0	0	0	0	0	0
	Annual	1	1	1	1	1	0	0	0
SE	Spring	9	5	2	2	1	2	0	.....
	Summer	6	3	0	0	0	0	0	.....
	Autumn	5	2	2	0	0	0	0	0
	Winter	2	1	1	0	0	0	0	0
	Annual	5	3	1	1	[1]0	1	0	0
SSE	Spring	11	9	7	3	2	2	0	.....
	Summer	15	18	8	4	6	3	0	.....
	Autumn	14	13	5	2	2	2	0	0
	Winter	10	4	2	1	0	0	0	0
	Annual	13	11	6	3	3	2	0	0
S	Spring	28	28	19	11	6	2	0	.....
	Summer	23	16	19	17	17	31	33	.....
	Autumn	30	27	28	22	16	13	0	0
	Winter	20	18	7	5	8	4	0	0
	Annual	25	23	19	15	12	12	6	0
SSW	Spring	8	13	26	24	22	4	14	.....
	Summer	22	25	28	28	24	12	33	.....
	Autumn	12	14	18	23	26	11	20	0
	Winter	8	14	20	14	10	4	0	0
	Annual	12	16	23	23	21	9	18	0
SW	Spring	6	6	9	21	26	25	0	.....
	Summer	9	12	15	19	24	31	17	.....
	Autumn	5	6	6	13	18	25	13	0
	Winter	12	8	14	20	15	4	0	0
	Annual	7	8	11	17	21	23	9	0
WSW	Spring	2	3	3	5	6	25	29	.....
	Summer	1	3	6	5	6	5	0	.....
	Autumn	[1]0	2	4	5	7	16	20	25
	Winter	3	7	7	8	8	15	20	0
	Annual	1	4	5	5	7	16	18	20
W	Spring	2	2	3	5	5	9	43	.....
	Summer	1	2	3	6	6	10	17	.....
	Autumn	3	3	5	7	7	8	26	75
	Winter	2	4	5	9	8	12	20	0
	Annual	3	3	4	6	7	9	28	60
WNW	Spring	2	1	2	2	4	7	0	.....
	Summer	1	1	0	0	1	5	0	.....
	Autumn	1	[1]0	1	1	3	5	7	0
	Winter	3	3	5	3	14	23	60	100
	Annual	2	1	2	2	4	8	12	20
NW	Spring	2	4	4	6	9	9	14	.....
	Summer	0	1	2	4	4	0	0	.....
	Autumn	3	3	3	2	1	3	7	0
	Winter	7	7	8	13	17	34	0	0
	Annual	3	3	4	6	7	9	6	0
NNW	Spring	5	4	5	3	3	9	0	.....
	Summer	3	2	2	2	1	3	0	.....
	Autumn	3	4	4	4	6	5	0	0
	Winter	5	5	8	7	8	0	0	0
	Annual	4	4	4	4	4	5	0	0

[1] Less than 0.5 per cent.

TABLE 13b.—*Average percentage frequency of free-air winds from different directions at Drexel, Nebr.*

Surface direction.	Season.	Altitude above m. s. l. (meters).							
		396	500	1,000	1,500	2,000	3,000	4,000	5,000
N	Spring	9	8	8	9	7	2	3	0
	Summer	7	7	6	5	4	4	2	0
	Autumn	9	9	7	6	6	3	1	0
	Winter	11	11	9	6	3	1	1	0
	Annual	9	9	8	6	5	2	2	0
NNE	Spring	6	6	6	4	4	2	1	0
	Summer	4	3	4	3	2	0	0	0
	Autumn	5	5	4	3	2	1	2	0
	Winter	4	4	3	2	1	1	0	0
	Annual	5	5	4	3	2	1	1	0
NE	Spring	6	6	5	4	4	1	0	0
	Summer	6	6	5	2	1	[1]0	0	0
	Autumn	4	5	4	2	2	1	0	0
	Winter	2	2	3	2	1	0	0	0
	Annual	5	4	4	3	2	1	0	0
ENE	Spring	5	5	4	2	1	1	3	0
	Summer	3	3	3	2	1	[1]0	0	0
	Autumn	1	1	2	1	[1]0	0	0	0
	Winter	3	3	1	[1]0	1	0	0	0
	Annual	3	3	3	1	1	[1]0	[1]0	0
E	Spring	3	4	3	4	2	1	1	0
	Summer	4	4	2	2	2	0	0	0
	Autumn	2	2	2	1	1	0	0	0
	Winter	2	1	2	1	1	1	0	0
	Annual	2	3	2	2	2	[1]0	[1]0	0
ESE	Spring	4	4	5	4	2	2	0	0
	Summer	5	6	4	2	1	0	1	0
	Autumn	2	2	1	1	[1]0	0	0	0
	Winter	2	2	1	2	1	[1]0	0	0
	Annual	3	3	3	2	1	[1]0	[1]0	0
SE	Spring	9	8	5	5	4	2	1	0
	Summer	7	6	7	4	2	1	0	0
	Autumn	3	2	2	2	2	1	1	0
	Winter	4	3	2	1	[1]0	1	0	0
	Annual	6	5	4	3	2	1	[1]0	0
SSE	Spring	9	9	8	6	6	3	1	0
	Summer	11	10	8	8	5	2	2	8
	Autumn	9	9	5	3	2	1	1	0
	Winter	7	7	3	2	1	[1]0	0	0
	Annual	9	9	6	5	4	2	2	2
S	Spring	9	9	10	10	8	4	3	0
	Summer	12	13	12	10	9	7	7	8
	Autumn	16	11	12	10	8	6	4	0
	Winter	6	8	5	4	4	2	1	0
	Annual	11	10	10	8	7	5	4	2
SSW	Spring	7	8	8	10	11	8	6	0
	Summer	15	15	14	18	18	14	15	0
	Autumn	12	12	17	15	13	11	7	0
	Winter	9	7	9	6	5	3	3	0
	Annual	10	10	12	12	11	9	8	0
SW	Spring	6	5	7	9	11	16	6	20
	Summer	7	8	11	12	17	19	15	8
	Autumn	7	12	8	12	16	11	11	16
	Winter	7	8	8	9	9	5	3	10
	Annual	7	8	8	11	13	12	9	13
WSW	Spring	3	3	4	6	7	12	12	10
	Summer	3	2	5	8	9	13	15	17
	Autumn	4	4	5	6	8	12	10	5
	Winter	6	5	9	11	10	12	16	0
	Annual	4	4	6	8	8	12	13	8
W	Spring	3	4	3	4	6	13	26	40
	Summer	2	2	2	5	5	9	10	0
	Autumn	2	2	5	7	7	11	23	26
	Winter	6	7	5	9	13	20	27	30
	Annual	3	4	4	6	8	14	21	24
WNW	Spring	3	4	5	5	7	12	16	10
	Summer	3	3	2	4	6	12	10	26
	Autumn	4	3	3	6	9	18	15	16
	Winter	6	6	8	10	16	28	31	40
	Annual	4	4	5	6	10	19	18	22
NW	Spring	8	7	9	10	11	12	17	20
	Summer	5	6	7	6	9	12	18	33
	Autumn	9	9	12	13	14	15	19	37
	Winter	9	10	14	19	21	18	16	20
	Annual	8	8	10	13	14	15	18	29
NNW	Spring	10	10	10	8	9	9	4	0
	Summer	6	6	8	9	9	7	5	0
	Autumn	11	12	11	12	10	9	6	0
	Winter	16	16	18	16	13	8	2	0
	Annual	11	11	11	11	10	8	4	0

[1] Less than 0.5 per cent.

TABLE 13c.—*Average percentage frequency of free-air winds from different directions at Ellendale, N. Dak.*

Surface direction.	Season.	Altitude above m. s. l. (meters).							
		444	500	1,000	1,500	2,000	3,000	4,000	5,000
N	Spring	11	10	10	7	7	2	6	0
	Summer	10	10	6	8	5	0	4	0
	Autumn	11	10	6	8	7	4	5	0
	Winter	10	10	9	7	8	4	2	0
	Annual	11	10	7	8	7	2	4	0
NNE	Spring	8	9	9	8	6	2	3	14
	Summer	6	6	7	5	3	2	0	0
	Autumn	7	8	7	3	2	0	0	0
	Winter	7	7	4	4	2	0	2	0
	Annual	7	7	7	5	3	1	1	3
NE	Spring	3	3	5	5	4	5	0	0
	Summer	5	4	5	3	3	3	2	0
	Autumn	6	5	9	4	1	1	0	0
	Winter	3	4	3	2	2	1	0	0
	Annual	4	4	6	3	2	2	1	0
ENE	Spring	5	4	4	4	3	2	3	14
	Summer	4	5	3	2	1	0	2	0
	Autumn	2	2	2	4	3	1	2	0
	Winter	2	2	4	3	1	0	0	0
	Annual	3	3	3	3	2	1	2	3
E	Spring	3	4	3	2	3	3	8	0
	Summer	3	3	3	2	2	1	0	0
	Autumn	2	2	2	3	2	0	0	0
	Winter	2	1	3	1	2	0	0	0
	Annual	2	2	3	2	2	1	2	0
ESE	Spring	3	3	2	4	2	0	0	0
	Summer	4	3	4	4	3	3	0	0
	Autumn	3	3	3	2	2	1	0	0
	Winter	2	2	2	1	0	0	0	0
	Annual	3	3	3	3	2	1	0	0
SE	Spring	4	4	5	3	4	2	0	0
	Summer	7	7	7	6	4	3	2	0
	Autumn	4	5	3	4	3	1	0	0
	Winter	2	2	1	2	1	0	0	0
	Annual	4	5	4	4	3	1	1	0
SSE	Spring	5	5	7	8	6	5	6	0
	Summer	10	11	9	6	6	3	0	0
	Autumn	6	5	5	2	4	2	5	0
	Winter	3	3	3	1	2	0	0	0
	Annual	6	6	6	4	5	3	3	0
S	Spring	18	18	12	10	12	8	0	0
	Summer	16	15	15	13	9	6	2	0
	Autumn	11	10	7	7	5	3	0	12
	Winter	9	8	5	3	2	2	2	0
	Annual	14	13	10	9	7	5	1	3
SSW	Spring	7	7	8	7	7	7	3	0
	Summer	8	8	10	12	16	7	6	0
	Autumn	7	7	9	10	8	8	5	0
	Winter	7	8	3	3	3	0	0	0
	Annual	7	8	8	8	9	6	4	0
SW	Spring	3	3	6	7	8	8	3	0
	Summer	3	3	5	8	9	10	4	11
	Autumn	3	3	4	8	9	10	13	0
	Winter	5	5	9	4	4	6	7	22
	Annual	3	3	6	7	7	9	7	9
WSW	Spring	2	2	3	5	5	11	14	14
	Summer	1	1	1	3	5	11	11	34
	Autumn	4	5	5	3	7	9	9	13
	Winter	3	4	3	7	6	5	7	11
	Annual	3	3	3	4	6	9	9	19
W	Spring	5	5	4	6	9	10	29	43
	Summer	5	6	3	6	7	12	34	22
	Autumn	8	8	8	6	9	12	20	62
	Winter	6	5	5	9	11	17	17	34
	Annual	6	6	5	6	9	13	24	39
WNW	Spring	3	3	5	6	6	15	17	15
	Summer	5	5	8	6	9	14	12	22
	Autumn	9	9	8	12	11	20	14	13
	Winter	6	7	12	17	19	22	26	11
	Annual	6	6	8	10	11	18	17	15
NW	Spring	11	11	8	10	12	14	8	0
	Summer	7	7	7	10	9	12	15	11
	Autumn	11	12	12	13	17	20	20	0
	Winter	18	18	17	18	23	33	28	11
	Annual	13	12	11	13	15	19	18	6
NNW	Spring	9	9	9	8	6	6	0	0
	Summer	6	6	7	6	9	13	6	0
	Autumn	6	6	10	11	10	8	7	0
	Winter	15	14	17	18	14	10	9	11
	Annual	9	9	10	11	10	9	6	3

TABLE 13d.—*Average percentage frequency of free-air winds from different directions at Groesbeck, Tex.*

Surface direction.	Season.	Altitude above m. s. l. (meters).							
		141	500	1,000	1,500	2,000	3,000	4,000	5,000
N	Spring	5	6	4	5	2	2	0	0
	Summer	3	2	2	1	0	0	0	.....
	Autumn	12	9	6	6	3	2	0	0
	Winter	18	15	11	7	4	3	10	0
	Annual	10	8	6	5	3	2	4	0
NNE	Spring	7	4	4	2	2	0	0	0
	Summer	1	2	2	0	0	0	0	.....
	Autumn	11	11	7	6	3	3	4	0
	Winter	10	6	6	3	2	3	0	0
	Annual	8	6	5	3	2	2	2	0
NE	Spring	3	5	4	4	2	0	0	0
	Summer	2	2	2	1	1	0	0	.....
	Autumn	4	5	5	6	4	1	10	50
	Winter	4	5	3	1	2	1	0	0
	Annual	4	5	3	4	2	1	4	12
ENE	Spring	3	2	3	2	2	0	0	0
	Summer	0	0	2	1	0	0	0	.....
	Autumn	2	2	5	2	1	2	10	0
	Winter	[1] 0	3	4	2	1	0	0	0
	Annual	2	2	4	2	1	1	4	0
E	Spring	4	1	1	0	0	0	0	0
	Summer	3	3	0	0	0	0	0	.....
	Autumn	4	3	2	3	3	3	0	0
	Winter	2	2	1	1	1	0	0	0
	Annual	3	2	1	1	1	1	0	0
ESE	Spring	6	5	1	1	1	0	0	0
	Summer	8	8	6	4	5	3	0	.....
	Autumn	5	5	3	1	1	1	0	0
	Winter	4	5	3	2	1	0	0	0
	Annual	6	5	3	2	1	1	0	0
SE	Spring	6	6	4	2	2	0	0	0
	Summer	8	6	7	6	5	3	0	.....
	Autumn	12	6	3	2	3	1	0	0
	Winter	4	2	2	0	1	0	0	0
	Annual	7	5	3	2	3	1	0	0
SSE	Spring	10	8	9	7	5	7	0	0
	Summer	12	10	11	8	9	6	33	.....
	Autumn	11	12	8	4	2	2	0	0
	Winter	2	2	3	3	3	3	0	0
	Annual	8	8	8	5	4	4	2	0
S	Spring	23	22	20	17	16	5	0	0
	Summer	14	14	10	13	17	24	0	.....
	Autumn	13	15	16	16	16	12	10	0
	Winter	11	10	5	3	4	5	10	0
	Annual	16	16	13	13	13	9	8	0
SSW	Spring	13	18	22	24	22	20	0	0
	Summer	21	25	24	29	27	33	0	.....
	Autumn	10	16	22	24	26	25	19	0
	Winter	13	14	18	18	11	3	10	0
	Annual	14	18	22	23	21	18	11	0
SW	Spring	4	5	6	9	15	19	12	0
	Summer	18	15	18	19	18	6	0	.....
	Autumn	2	3	6	7	8	9	19	0
	Winter	8	9	11	13	19	17	10	0
	Annual	7	7	10	11	14	13	13	0
WSW	Spring	3	4	4	6	7	20	38	0
	Summer	6	8	11	13	9	16	0	.....
	Autumn	3	1	3	5	7	13	4	0
	Winter	1	3	5	8	8	16	10	0
	Annual	3	4	5	7	8	16	11	0
W	Spring	1	2	4	6	7	10	12	0
	Summer	0	1	0	1	3	0	33	.....
	Autumn	1	1	2	3	5	9	10	50
	Winter	3	3	5	9	11	21	13	75
	Annual	1	2	3	5	7	11	13	50
WNW	Spring	2	2	2	2	4	5	26	100
	Summer	1	1	1	0	0	3	0	.....
	Autumn	2	2	2	3	3	6	0	0
	Winter	4	5	6	9	11	11	13	0
	Annual	2	2	3	4	5	7	9	25
NW	Spring	2	3	3	6	5	5	12	0
	Summer	0	0	1	2	3	6	0	.....
	Autumn	4	6	5	8	10	6	10	0
	Winter	6	7	6	8	9	9	19	25
	Annual	3	4	4	6	7	7	13	13
NNW	Spring	8	7	9	7	8	7	0	0
	Summer	3	3	3	2	3	0	34	.....
	Autumn	4	3	5	4	5	5	4	0
	Winter	10	9	11	13	12	8	5	0
	Annual	6	6	7	7	8	6	6	0

[1] Less than 0.5 per cent.

TABLE 13e.—*Average percentage frequency of free-air winds from different directions at Leesburg, Ga.*

Surface direction.	Season.	Altitude above m. s. l. (meters).							
		85	500	1,000	1,500	2,000	3,000	4,000	5,000
N	Spring	4	7	5	5	0	0	0	0
	Summer	2	2	5	4	0	0	0	.....
	Autumn	4	4	5	6	3	5	14	0
	Winter	4	1	5	3	2	0	0	0
	Annual	4	4	5	4	1	1	4	0
NNE	Spring	5	3	0	0	3	0	0	0
	Summer	0	0	0	0	4	0	0	.....
	Autumn	4	4	5	3	3	5	0	0
	Winter	5	5	5	3	2	3	0	0
	Annual	4	3	2	2	3	2	0	0
NE	Spring	4	1	1	2	3	4	0	0
	Summer	4	4	3	4	4	0	0	.....
	Autumn	11	11	9	9	10	5	0	0
	Winter	6	1	0	2	0	0	0	0
	Annual	6	3	3	3	3	2	0	0
ENE	Spring	5	5	3	2	0	0	0	0
	Summer	11	5	5	11	11	6	0	.....
	Autumn	13	11	17	19	14	11	0	0
	Winter	8	10	6	5	4	3	0	0
	Annual	8	7	7	7	6	4	0	0
E	Spring	6	9	4	0	0	0	0	0
	Summer	24	32	28	22	23	20	40	.....
	Autumn	20	22	14	12	10	12	0	0
	Winter	2	4	3	3	2	0	0	0
	Annual	11	14	10	7	7	5	8	0
ESE	Spring	7	4	4	3	3	0	0	0
	Summer	7	4	8	11	11	13	0	.....
	Autumn	6	6	5	6	7	0	0	0
	Winter	1	2	5	2	0	0	0	0
	Annual	5	4	5	4	4	2	0	0
SE	Spring	5	6	5	5	0	0	0	0
	Summer	4	4	5	7	8	7	0	.....
	Autumn	8	8	12	9	7	0	0	0
	Winter	0	1	0	0	0	0	0	0
	Annual	4	5	5	4	3	1	0	0
SSE	Spring	9	6	1	3	3	0	0	0
	Summer	0	2	8	4	4	0	0	.....
	Autumn	6	4	2	0	3	5	0	0
	Winter	4	0	0	2	0	0	0	0
	Annual	5	3	2	2	2	1	0	0
S	Spring	12	11	14	7	5	0	0	0
	Summer	4	4	0	4	4	6	0	.....
	Autumn	6	10	2	3	3	0	0	0
	Winter	12	12	5	1	0	0	0	0
	Annual	10	10	6	4	3	1	0	0
SSW	Spring	13	15	20	21	16	4	0	0
	Summer	5	8	10	4	4	7	0	.....
	Autumn	6	4	12	15	7	5	14	0
	Winter	6	8	15	15	13	8	0	0
	Annual	8	10	15	15	11	6	4	0
SW	Spring	6	4	9	12	16	20	25	0
	Summer	8	7	5	0	0	7	40	.....
	Autumn	2	4	5	6	13	21	43	0
	Winter	9	4	6	5	10	19	17	0
	Annual	7	5	7	7	11	18	31	0
WSW	Spring	1	5	4	10	13	28	25	50
	Summer	6	5	8	11	11	13	20	.....
	Autumn	4	0	0	0	3	5	0	0
	Winter	11	17	7	8	7	5	0	0
	Annual	5	8	5	8	8	13	11	25
W	Spring	2	4	7	8	19	16	13	50
	Summer	17	17	10	11	8	7	0	.....
	Autumn	2	4	2	3	7	16	29	100
	Winter	9	9	13	15	18	19	33	0
	Annual	7	8	9	10	14	16	19	50
WNW	Spring	12	9	8	8	8	16	13	0
	Summer	4	2	5	7	8	7	0	.....
	Autumn	2	2	5	3	7	5	0	0
	Winter	10	8	12	18	20	24	33	0
	Annual	8	6	8	11	12	16	11	0
NW	Spring	6	9	12	12	8	8	12	0
	Summer	4	4	0	0	0	7	0	.....
	Autumn	0	0	0	6	0	0	0	0
	Winter	9	10	12	13	13	19	17	100
	Annual	5	6	8	10	7	10	8	25
NNW	Spring	3	2	3	2	3	4	12	0
	Summer	0	0	0	0	0	0	0	.....
	Autumn	6	6	5	0	3	5	0	0
	Winter	4	8	6	5	9	0	0	0
	Annual	3	4	3	2	5	2	4	0

TABLE 13f.—*Average percentage frequency of free-air winds from different directions at Royal Center, Ind.*

Surface direction.	Season.	Altitude above m. s. l. (meters).							
		225	500	1,000	1,500	2,000	3,000	4,000	5,000
N	Spring	3	2	2	3	4	4	0	0
	Summer	7	5	6	6	4	0	0	.....
	Autumn	1	3	3	2	4	5	6	.....
	Winter	1	0	0	2	3	0	0	.....
	Annual	3	3	3	3	4	2	2	0
NNE	Spring	6	5	6	4	2	2	0	0
	Summer	4	7	7	4	4	3	0	.....
	Autumn	5	4	2	3	2	1	0	.....
	Winter	2	2	3	1	1	3	0	.....
	Annual	4	4	4	3	2	2	0	0
NE	Spring	4	6	2	5	4	2	0	0
	Summer	3	2	1	3	3	2	0	.....
	Autumn	3	3	1	0	0	0	0	.....
	Winter	2	2	3	1	1	0	0	.....
	Annual	2	3	1	2	2	1	0	0
ENE	Spring	3	3	7	5	4	5	7	0
	Summer	2	3	4	4	2	2	0	.....
	Autumn	1	2	2	3	1	0	0	.....
	Winter	5	5	4	1	1	2	0	.....
	Annual	3	3	4	3	2	2	2	0
E	Spring	11	9	5	3	6	4		0
	Summer	6	3	2	1	2	0	0	.....
	Autumn	4	3	5	3	2	0	0	.....
	Winter	4	3	3	1	1	2	0	.....
	Annual	6	4	4	2	2	1	2	0
ESE	Spring	4	5	7	2	0	0	0	0
	Summer	3	5	2	0	0	0	0	.....
	Autumn	4	1	0	1	1	0	0	.....
	Winter	3	3	1	1	0	0	0	.....
	Annual	4	3	2	1	[1] 0	0	0	0
SE	Spring	6	5	2	4	2	0	0	0
	Summer	5	2	3	3	1	0	0	.....
	Autumn	6	6	2	1	0	0	0	.....
	Winter	5	2	1	1	1	0	0	.....
	Annual	6	4	3	2	1	0	0	0
SSE	Spring	7	2	2	2	0	0	0	0
	Summer	4	5	4	1	2	0	0	.....
	Autumn	5	5	5	4	2	1	0	.....
	Winter	10	8	3	1	1	2	0	.....
	Annual	6	5	4	2	2	1	0	0
S	Spring	10	6	7	5	3	4	0	0
	Summer	6	6	2	3	1	0	0	.....
	Autumn	9	7	8	5	2	1	0	.....
	Winter	3	6	8	3	3	3	0	.....
	Annual	7	7	6	4	3	2	0	0
SSW	Spring	6	12	6	6	7	4	7	0
	Summer	8	8	8	3	3	2	10	.....
	Autumn	12	11	8	9	10	9	0	.....
	Winter	7	7	6	10	7	5	14	.....
	Annual	12	12	14	15	19	20	19	0
SW	Spring	8	10	16	16	18	13	12	0
	Summer	13	12	12	19	26	26	20	.....
	Autumn	14	14	17	14	21	20	19	.....
	Winter	13	10	11	12	14	19	29	.....
	Annual	9	10	7	8	6	5	6	0
WSW	Spring	8	10	11	15	13	13	7	0
	Summer	17	21	20	19	21	16	10	.....
	Autumn	8	12	11	14	12	18	25	.....
	Winter	9	15	13	15	15	10	14	.....
	Annual	10	14	14	16	15	15	15	0
W	Spring	13	11	10	11	14	18	20	0
	Summer	11	8	14	17	11	21	20	.....
	Autumn	11	11	14	17	19	23	19	.....
	Winter	23	18	21	22	23	27	29	.....
	Annual	14	12	15	17	17	22	20	0
WNW	Spring	3	6	7	6	4	17	20	50
	Summer	3	5	8	8	9	13	10	.....
	Autumn	10	10	10	8	8	12	19	.....
	Winter	8	11	14	19	20	23	14	.....
	Annual	7	8	10	10	11	16	17	50
NW	Spring	4	4	6	9	13	9	20	0
	Summer	4	4	5	6	6	8	30	.....
	Autumn	5	5	8	8	12	6	6	.....
	Winter	2	5	6	9	8	3	0	.....
	Annual	4	5	7	8	10	7	15	0
NNW	Spring	4	4	4	4	4	5	0	50
	Summer	4	4	2	3	5	7	0	.....
	Autumn	2	3	4	8	4	4	6	.....
	Winter	3	3	3	1	1	1	0	.....
	Annual	3	3	3	4	4	4	2	50

[1] Less than 0.5 per cent.

TABLE 14a.—*Average percentage frequency of clockwise (cw.) and counterclockwise (ccw.) turning of winds from surface direction at Broken Arrow, Okla.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 500 cw.	500 ccw.	1,000 cw.	1,000 ccw.	2,000 cw.	2,000 ccw.	3,000 cw.	3,000 ccw.	4,000 cw.	4,000 ccw.	5,000 cw.	5,000 ccw.
N	Spring	27	0	38	0	40	20	0	0	.....	.....	.....	.....
	Summer	0	0	50	0	0	0	.....	.....	.....	.....	.....	.....
	Autumn	25	8	50	9	10	40	0	100	0	100	.....	.....
	Winter	14	0	39	22	11	56	0	67	.....	.....	.....	.....
	Annual	20	3	44	12	15	38	0	67	0	100	.....	.....
NNE	Spring	8	17	18	45	44	44	67	33	100	0	.....	.....
	Summer	50	17	80	0	0	0	.....	.....	.....	.....	.....	.....
	Autumn	35	0	56	0	38	25	33	67	.....	.....	.....	.....
	Winter	23	8	46	15	40	20	.....	.....	.....	.....	.....	.....
	Annual	27	8	47	16	38	29	50	50	100	0	.....	.....
NE	Spring	25	0	62	0	60	20	100	0	.....	.....	.....	.....
	Summer	18	18	10	20	12	62	.....	.....	.....	.....	.....	.....
	Autumn	18	0	20	10	20	60	0	100	0	100	.....	.....
	Winter	20	20	50	25	0	100	0	100	.....	.....	.....	.....
	Annual	20	9	31	12	26	53	17	83	0	100	.....	.....
ENE	Spring	33	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Summer	0	0	0	0	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	0	0	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	17	0	60	0	100	0	.....	.....	.....	.....	.....	.....
E	Spring	75	0	100	0	67	0	.....	.....	.....	.....	.....	.....
	Summer	33	33	33	33	0	0	.....	.....	.....	.....	.....	.....
	Autumn	100	0	0	0	0	100	.....	.....	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	62	12	62	12	50	0	.....	.....	.....	.....	.....	.....
ESE	Spring	67	0	67	0	50	50	100	0	100	0	.....	.....
	Summer	100	0	100	0	100	0	100	0	.....	.....	.....	.....
	Autumn	0	0	100	0	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	50	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Annual	62	0	88	0	80	20	100	0	100	0	.....	.....
SE	Spring	36	21	77	8	89	11	67	33	.....	.....	.....	.....
	Summer	75	0	100	0	100	0	100	0	100	0	.....	.....
	Autumn	60	0	100	0	100	0	100	0	100	0	100	0
	Winter	67	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Annual	54	9	91	3	96	4	89	11	100	0	100	0
SSE	Spring	53	0	84	0	92	8	100	0	100	0	.....	.....
	Summer	9	5	57	5	81	0	83	0	100	0	.....	.....
	Autumn	37	0	76	3	95	0	100	0	100	0	100	0
	Winter	86	0	100	0	100	0	100	0	.....	.....	.....	.....
	Annual	41	1	77	2	90	2	96	0	100	0	100	0
S	Spring	24	2	65	2	94	0	100	0	100	0	.....	.....
	Summer	36	3	61	3	72	4	73	0	100	0	.....	.....
	Autumn	19	3	39	3	72	3	70	5	100	0	.....	.....
	Winter	31	7	79	0	92	0	100	0	100	0	.....	.....
	Annual	26	4	57	2	81	2	82	2	100	0	.....	.....
SSW	Spring	15	15	46	15	83	0	86	0	100	0	.....	.....
	Summer	22	0	42	0	57	5	62	31	0	50	.....	.....
	Autumn	28	0	45	0	71	6	43	29	.....	.....	.....	.....
	Winter	33	0	58	0	80	0	67	0	100	0	.....	.....
	Annual	24	2	46	3	69	4	63	20	60	20	.....	.....
SW	Spring	10	10	30	20	75	0	100	0	100	0	.....	.....
	Summer	8	8	25	17	0	38	0	33	.....	.....	.....	.....
	Autumn	44	0	89	0	71	0	83	17	67	33	100	0
	Winter	56	6	82	6	100	0	100	0	100	0	100	0
	Annual	32	6	58	10	60	10	76	12	80	20	100	0
WSW	Spring	0	0	0	50	50	50	.....	.....	.....	.....	.....	.....
	Summer	50	0	100	0	100	0	100	0	.....	.....	.....	.....
	Autumn	0	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Winter	25	0	67	33	50	50	.....	.....	.....	.....	.....	.....
	Annual	20	0	57	29	67	33	100	0	.....	.....	.....	.....
W	Spring	0	25	0	25	33	0	0	0	.....	.....	.....	.....
	Summer	0	0	0	0	0	50	.....	.....	.....	.....	.....	.....
	Autumn	0	0	17	17	33	33	100	0	.....	.....	.....	.....
	Winter	0	0	33	0	50	0	0	0	.....	.....	.....	.....
	Annual	0	7	13	13	30	20	50	0	.....	.....	.....	.....
WNW	Spring	25	25	50	25	50	25	100	0	.....	.....	.....	.....
	Summer	50	0	100	0	100	0	0	0	.....	.....	.....	.....
	Autumn	50	0	100	0	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	50	0	100	0	100	0	100	0	.....	.....	.....	.....
	Annual	42	8	83	8	75	12	75	0	.....	.....	.....	.....
NW	Spring	0	0	0	50	33	0	100	0	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	17	0	67	17	60	40	33	33	.....	.....	.....	.....
	Winter	10	20	20	20	20	20	0	25	0	100	.....	.....
	Annual	10	10	30	25	38	23	25	25	0	100	.....	.....
NNW	Spring	0	22	11	22	14	71	0	50	0	100	.....	.....
	Summer	25	0	25	0	0	100	.....	.....	.....	.....	.....	.....
	Autumn	14	0	20	20	0	33	.....	.....	.....	.....	.....	.....
	Winter	0	12	14	14	0	67	0	100	.....	.....	.....	.....
	Annual	7	11	16	16	7	64	0	60	0	100	.....	.....
Means	Spring	25	8	54	11	72	14	81	9	86	14	.....	.....
	Summer	27	5	50	5	57	12	67	13	67	17	.....	.....
	Autumn	27	2	52	4	64	12	66	21	80	20	100	0
	Winter	33	5	63	9	60	18	58	19	80	20	100	0
	Annual	28	5	54	7	64	14	69	16	79	18	100	0

TABLE 14b.—*Average percentage frequency of clockwise (cw.) and counterclockwise (ccw.) turning of winds from surface direction at Drexel, Nebr.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 500 cw.	500 ccw.	1,000 cw.	1,000 ccw.	2,000 cw.	2,000 ccw.	3,000 cw.	3,000 ccw.	4,000 cw.	4,000 ccw.	5,000 cw.	5,000 ccw.
N	Spring	2	0	15	22	19	49	9	74	0	80	.....	.....
	Summer	0	3	7	24	12	54	0	76	0	100	0	100
	Autumn	0	0	19	24	11	54	4	83	9	91	0	100
	Winter	2	5	17	30	11	72	4	87	0	100	.....	.....
	Annual	1	2	15	25	14	58	5	80	4	93	0	100
NNE	Spring	0	0	23	26	19	57	10	70	0	100	0	100
	Summer	0	12	12	47	18	82	14	86	0	100	.....	.....
	Autumn	11	4	41	15	43	50	0	100	0	100	0	100
	Winter	10	0	45	30	65	24	50	50	.....	.....	.....	.....
	Annual	5	3	31	27	37	51	18	71	0	100	0	100
NE	Spring	6	3	33	27	30	25	40	30	67	33	.....	.....
	Summer	3	0	24	21	44	56	38	62	29	71	.....	.....
	Autumn	0	0	21	16	40	53	12	78	0	100	.....	.....
	Winter	10	10	44	11	75	25	0	100	.....	.....	.....	.....
	Annual	4	2	29	21	40	42	30	58	36	64	.....	.....
ENE	Spring	4	0	56	13	69	23	100	0	100	0	.....	.....
	Summer	13	0	26	20	33	42	25	75	100	0	.....	.....
	Autumn	0	0	29	0	25	50	50	50	.....	.....	.....	.....
	Winter	12	0	86	0	100	0	100	0	.....	.....	.....	.....
	Annual	8	0	53	10	63	24	76	24	100	0	.....	.....
E	Spring	12	0	50	19	55	27	86	14	100	0	100	0
	Summer	21	0	47	16	78	11	100	0	100	0	.....	.....
	Autumn	25	0	50	8	78	11	100	0	.....	.....	.....	.....
	Winter	33	11	67	0	83	0	83	0	100	0	.....	.....
	Annual	21	2	52	12	71	14	90	5	100	0	100	0
ESE	Spring	15	5	45	5	85	8	100	0	100	0	.....	.....
	Summer	4	0	57	0	100	0	100	0	.....	.....	.....	.....
	Autumn	10	0	100	0	100	0	100	0	100	0	100	0
	Winter	25	0	100	0	100	0	100	0	100	0	.....	.....
	Annual	12	2	66	2	95	3	100	0	100	0	100	0
SE	Spring	13	2	52	9	87	8	93	4	89	0	.....	.....
	Summer	15	0	58	0	79	8	92	0	100	0	.....	.....
	Autumn	43	0	79	0	85	0	89	0	100	0	.....	.....
	Winter	35	0	95	0	100	0	100	0	100	0	100	0
	Annual	21	1	64	4	88	5	94	2	94	0	100	0
SSE	Spring	7	0	49	7	77	10	96	4	100	0	100	0
	Summer	16	0	59	4	77	2	87	0	85	0	67	0
	Autumn	17	0	73	0	87	5	100	0	100	0	100	0
	Winter	24	0	88	0	100	0	100	0	100	0	.....	.....
	Annual	16	0	66	3	84	5	96	1	94	0	80	0
S	Spring	6	0	49	0	83	0	96	0	80	0	.....	.....
	Summer	7	2	48	2	79	5	92	4	78	11	.....	.....
	Autumn	6	12	56	4	81	3	83	4	84	5	100	0
	Winter	12	0	88	0	96	4	96	0	100	0	.....	.....
	Annual	7	1	57	2	83	3	90	3	86	5	100	0
SSW	Spring	0	0	46	14	63	9	82	0	88	0	100	0
	Summer	6	1	43	11	50	14	55	14	46	19	50	50
	Autumn	5	0	47	2	83	0	88	0	94	0	100	0
	Winter	30	2	91	0	97	0	100	0	100	0	100	0
	Annual	9	1	54	6	72	5	77	5	74	8	88	12
SW	Spring	14	0	36	7	67	0	78	0	100	0	100	0
	Summer	3	3	28	9	47	20	55	23	67	33	.....	.....
	Autumn	9	0	53	6	76	7	88	8	80	20	.....	.....
	Winter	22	0	80	0	97	0	96	0	100	0	100	0
	Annual	12	1	50	5	72	7	80	7	87	13	100	0
WSW	Spring	29	0	65	0	90	0	87	0	100	0	.....	.....
	Summer	9	0	45	0	60	30	38	38	50	50	.....	.....
	Autumn	15	0	58	0	71	0	82	0	89	11	100	0
	Winter	36	0	70	4	92	4	91	0	75	0	100	0
	Annual	25	0	62	1	82	7	80	6	84	8	100	0
W	Spring	13	0	40	20	62	15	50	12	60	20	100	0
	Summer	0	0	57	0	83	17	80	20	67	33	100	0
	Autumn	10	0	60	0	50	12	50	25	50	0	.....	.....
	Winter	17	0	79	3	86	7	88	0	72	7	.....	.....
	Annual	13	0	64	7	75	11	76	7	67	12	100	0
WNW	Spring	0	6	19	12	27	45	29	57	40	40	0	100
	Summer	13	7	43	29	50	29	45	45	75	0	100	0
	Autumn	17	0	56	0	59	18	25	42	29	43	0	100
	Winter	11	0	54	7	54	15	35	17	12	62	0	100
	Annual	10	3	45	11	50	24	34	34	33	42	33	67
NW	Spring	5	3	11	3	0	37	4	61	0	75	.....	.....
	Summer	0	0	17	17	14	32	5	47	12	62	0	0
	Autumn	7	0	25	2	24	24	23	40	13	67	0	50
	Winter	6	0	30	4	24	21	17	48	25	75	.....	.....
	Annual	5	1	22	5	17	27	14	48	13	68	0	33
NNW	Spring	0	0	10	22	10	49	0	64	0	86	0	100
	Summer	4	0	11	25	12	40	5	60	10	70	0	100
	Autumn	3	0	12	27	14	46	6	69	12	76	0	100
	Winter	1	1	13	14	8	55	3	80	0	100	0	100
	Annual	2	1	12	21	11	49	4	70	6	83	0	100
Means	Spring	7	1	36	13	52	22	58	25	61	29	60	40
	Summer	7	2	38	12	52	23	50	30	50	34	50	33
	Autumn	9	0	44	8	57	19	57	27	56	35	47	47
	Winter	15	1	56	8	63	20	62	25	65	28	70	30
	Annual	9	1	44	10	56	21	57	27	57	32	55	39

TABLE 14c.—*Average percentage frequency of clockwise (cw.) and counterclockwise (ccw.) turning of winds from surface direction at Ellendale, N. Dak.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 500 cw.	500 ccw.	1,000 cw.	1,000 ccw.	2,000 cw.	2,000 ccw.	3,000 cw.	3,000 ccw.	4,000 cw.	4,000 ccw.	5,000 cw.	5,000 ccw.
N	Spring	3	0	43	4	40	30	33	58	33	67	100	0
	Summer	4	0	41	15	29	53	20	80	0	75	0	100
	Autumn	16	0	67	10	27	40	17	67	0	0	.....	.....
	Winter	17	0	58	17	47	40	0	100	0	50	.....	.....
	Annual	9	0	52	11	36	40	21	74	10	60	50	50
NNE	Spring	0	0	48	5	60	30	50	33	33	67	.....	.....
	Summer	6	6	33	17	17	50	40	40	0	100	.....	.....
	Autumn	5	5	55	10	60	29	50	50	50	50	.....	.....
	Winter	6	6	56	25	14	86	0	100	.....	.....	.....	.....
	Annual	4	4	48	13	38	44	33	57	33	67	.....	.....
NE	Spring	0	0	38	12	40	20	0	100	0	100	.....	.....
	Summer	15	0	31	8	50	17	50	0	0	0	.....	.....
	Autumn	13	0	53	7	60	30	50	50	.....	.....	.....	.....
	Winter	0	0	83	0	75	0	0	0	.....	.....	.....	.....
	Annual	9	0	48	7	56	20	33	33	0	50	.....	.....
ENE	Spring	8	0	67	0	78	11	100	0	100	0	.....	.....
	Summer	8	0	67	0	75	0	.....	.....	.....	.....	.....	.....
	Autumn	29	0	71	0	100	0	100	0	100	0	.....	.....
	Winter	0	0	75	0	100	0	.....	.....	.....	.....	.....	.....
	Annual	11	0	69	0	85	5	100	0	100	0	.....	.....
E	Spring	0	0	56	11	83	17	100	0	.....	.....	.....	.....
	Summer	0	0	60	20	67	0	100	0	100	0	.....	.....
	Autumn	50	0	67	17	83	17	80	20	100	0	.....	.....
	Winter	50	0	75	0	100	0	100	0	.....	.....	.....	.....
	Annual	19	0	62	12	83	11	89	11	100	0	.....	.....
ESE	Spring	0	0	88	0	80	0	100	0	.....	.....	.....	.....
	Summer	10	0	60	10	67	11	67	0	.....	.....	.....	.....
	Autumn	22	0	78	0	86	0	100	0	100	0	100	0
	Winter	20	0	100	0	100	0	100	0	100	0	100	0
	Annual	12	0	78	3	81	4	91	0	100	0	100	0
SE	Spring	0	0	40	10	70	0	80	0	100	0	.....	.....
	Summer	0	0	39	6	79	7	83	0	67	0	100	0
	Autumn	17	0	82	0	100	0	100	0	100	0	.....	.....
	Winter	20	0	100	0	100	0	100	0	.....	.....	.....	.....
	Annual	6	0	57	5	85	3	90	0	80	0	100	0
SSE	Spring	0	0	36	0	62	8	86	14	100	0	.....	.....
	Summer	0	0	50	4	92	8	94	6	100	0	100	0
	Autumn	7	13	73	0	100	0	100	0	100	0	100	0
	Winter	0	0	100	0	100	0	100	0	.....	.....	.....	.....
	Annual	2	3	58	2	87	6	94	6	100	0	100	0
S	Spring	2	0	35	8	50	15	60	20	67	33	100	0
	Summer	2	2	38	7	75	17	73	23	78	11	100	0
	Autumn	13	0	66	7	89	0	100	0	100	0	100	0
	Winter	18	0	67	0	88	0	91	0	83	0	.....	.....
	Annual	7	1	46	6	71	10	76	14	82	11	100	0
SSW	Spring	5	0	56	6	87	6	91	0	100	0	100	0
	Summer	5	0	38	5	70	0	86	0	100	0	.....	.....
	Autumn	11	0	63	0	81	6	92	0	88	0	.....	.....
	Winter	17	0	83	0	93	0	100	0	100	0	100	0
	Annual	9	0	59	3	82	3	92	0	95	0	100	0
SW	Spring	0	0	33	0	50	0	100	0	.....	.....	.....	.....
	Summer	12	0	38	0	100	0	100	0	100	0	.....	.....
	Autumn	0	0	62	12	86	0	60	0	100	0	.....	.....
	Winter	27	0	73	9	100	0	100	0	75	0	100	0
	Annual	12	0	53	6	86	0	89	0	86	0	100	0
WSW	Spring	0	0	60	0	75	0	100	0	100	0	.....	.....
	Summer	33	33	33	33	67	33	67	33	.....	.....	.....	.....
	Autumn	0	0	75	8	75	25	100	0	100	0	100	0
	Winter	14	0	86	0	100	0	100	0	100	0	100	0
	Annual	7	4	70	7	81	15	95	5	100	0	100	0
W	Spring	0	0	50	7	58	17	60	30	33	33	.....	.....
	Summer	0	0	50	0	50	10	14	57	0	50	.....	.....
	Autumn	4	0	70	0	73	5	67	27	50	33	0	0
	Winter	14	0	79	0	92	0	80	10	100	0	.....	.....
	Annual	5	0	63	14	70	7	60	29	46	31	0	0
WNW	Spring	0	0	33	0	17	50	0	100	0	100	0	100
	Summer	0	7	21	0	36	21	33	33	38	50	100	0
	Autumn	8	0	62	8	65	4	53	16	44	33	0	100
	Winter	0	0	60	0	64	14	43	14	33	33	.....	.....
	Annual	3	2	49	3	53	16	39	32	35	46	33	67
NW	Spring	0	0	29	11	17	17	7	40	0	100	0	100
	Summer	0	0	28	11	31	31	8	58	14	29	0	100
	Autumn	0	3	45	10	35	31	28	61	28	28	.....	.....
	Winter	2	0	33	9	31	34	4	42	12	50	33	67
	Annual	1	1	34	10	29	29	12	49	15	41	20	80
NNW	Spring	0	0	43	9	53	18	33	33	75	25	50	50
	Summer	0	0	19	12	8	58	0	56	0	50	0	100
	Autumn	0	0	44	11	36	7	25	50	33	33	.....	.....
	Winter	3	0	26	11	28	34	15	54	0	86	0	100
	Annual	1	0	33	11	32	29	19	48	28	56	25	75
Means	Spring	1	0	44	6	53	16	54	28	54	43	57	43
	Summer	4	1	38	8	58	21	52	31	50	27	67	33
	Autumn	10	1	62	6	68	12	67	22	68	16	75	12
	Winter	10	0	58	7	62	20	50	28	52	28	67	33
	Annual	6	1	51	7	61	17	56	27	57	27	67	30

TABLE 14d.—*Average percentage frequency of clockwise (cw.) and counterclockwise (ccw.) turning of winds from surface direction at Groesbeck, Tex.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 500 cw.	500 ccw.	1,000 cw.	1,000 ccw.	2,000 cw.	2,000 ccw.	3,000 cw.	3,000 ccw.	4,000 cw.	4,000 ccw.	5,000 cw.	5,000 ccw.
N	Spring	10	20	11	44	0	100	0	100	.....	.....	.....	.....
	Summer	50	0	33	0	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	33	7	48	10	10	60	14	71	33	67	.....	.....
	Winter	31	11	37	19	21	72	0	86	0	100	0	100
	Annual	31	10	37	18	15	70	7	80	17	83	0	100
NNE	Spring	29	29	36	29	0	64	0	100	0	100	0	100
	Summer	50	0	50	0	100	0	.....	.....	.....	.....	.....	.....
	Autumn	30	9	44	11	33	33	38	50	50	0	.....	.....
	Winter	47	21	41	29	33	50	33	50	33	67	0	100
	Annual	36	17	41	22	28	47	23	61	25	62	0	100
NE	Spring	17	17	40	20	0	50	0	100	.....	.....	.....	.....
	Summer	33	0	67	0	0	0	.....	.....	.....	.....	.....	.....
	Autumn	38	0	71	0	40	0	67	33	50	0	100	0
	Winter	56	11	67	17	0	100	.....	.....	.....	.....	.....	.....
	Annual	38	8	62	10	22	22	50	50	50	0	100	
ENE	Spring	50	17	50	17	40	40	.....	.....	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	50	0	33	33	67	33	0	100	.....	.....	.....	.....
	Winter	0	100	0	100	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	46	18	40	30	50	38	0	100	.....	.....	.....	.....
E	Spring	86	14	83	17	100	0	.....	.....	.....	.....	.....	.....
	Summer	75	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Autumn	62	0	75	12	100	0	100	0	.....	.....	.....	.....
	Winter	75	0	100	0	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	74	4	85	10	100	0	100	0	.....	.....	.....	.....
ESE	Spring	67	0	82	0	86	0	100	0	.....	.....	.....	.....
	Summer	45	9	70	10	67	0	100	0	.....	.....	.....	.....
	Autumn	40	0	57	14	75	25	67	33	.....	.....	.....	.....
	Winter	22	0	100	0	100	0	100	0	100	0	.....	.....
	Annual	45	2	77	6	85	5	91	9	100	0	.....	.....
SE	Spring	58	8	82	0	89	0	100	0	.....	.....	.....	.....
	Summer	18	45	57	43	50	25	.....	.....	.....	.....	.....	.....
	Autumn	68	0	83	0	89	0	90	0	100	0	.....	.....
	Winter	100	0	100	0	100	0	100	0	.....	.....	.....	.....
	Annual	61	11	81	6	87	3	94	0	100	0	.....	.....
SSE	Spring	58	0	83	0	100	0	80	0	100	0	.....	.....
	Summer	29	0	38	12	60	20	75	12	0	0	.....	.....
	Autumn	62	0	86	0	94	0	100	0	100	0	.....	.....
	Winter	100	0	100	0	100	0	100	0	.....	.....	.....	.....
	Annual	55	0	73	3	86	5	88	4	80	0	.....	.....
S	Spring	27	2	54	2	74	3	86	0	100	0	.....	.....
	Summer	23	5	53	13	58	25	67	0	100	0	.....	.....
	Autumn	40	7	61	4	60	4	84	0	100	0	100	0
	Winter	48	0	87	0	89	0	93	0	100	0	.....	.....
	Annual	33	3	62	4	71	6	85	0	100	0	100	0
SSW	Spring	15	7	40	16	63	16	82	0	100	0	.....	.....
	Summer	13	7	33	17	40	25	22	33	.....	.....	.....	.....
	Autumn	14	0	48	0	52	5	56	12	0	33	.....	.....
	Winter	32	12	44	9	67	0	93	0	100	0	100	0
	Annual	18	7	38	10	56	11	66	10	50	17	100	0
SW	Spring	33	11	62	25	50	17	33	33	.....	.....	.....	.....
	Summer	19	22	30	33	19	50	50	25	.....	.....	.....	.....
	Autumn	0	50	25	50	50	50	67	33	.....	.....	.....	.....
	Winter	29	12	60	20	73	13	100	0	100	0	100	0
	Annual	23	19	43	30	46	32	74	16	100	0	100	0
WSW	Spring	0	17	33	33	40	20	25	25	0	0	.....	.....
	Summer	11	22	14	29	20	20	0	0	.....	.....	.....	.....
	Autumn	50	17	50	50	50	50	100	0	.....	.....	.....	.....
	Winter	50	50	50	50	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	22	22	32	37	36	29	33	17	0	0	.....	.....
W	Spring	0	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Winter	29	0	57	0	60	20	50	50	100	0	.....	.....
	Annual	45	0	70	0	71	14	50	50	100	0	.....	.....
WNW	Spring	25	25	25	50	50	50	0	50	.....	.....	.....	.....
	Summer	0	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Autumn	75	0	75	0	50	0	0	0	.....	.....	.....	.....
	Winter	25	12	43	14	43	29	50	50	0	100	.....	.....
	Annual	35	12	50	19	50	21	25	38	0	100	.....	.....
NW	Spring	25	0	25	50	25	50	0	50	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	11	11	25	25	14	29	17	50	50	50	.....	.....
	Winter	0	15	33	33	36	55	25	62	0	100	.....	.....
	Annual	8	12	29	33	27	4	19	56	33	67	.....	.....
NNW	Spring	7	27	0	23	0	40	0	23	0	100	.....	.....
	Summer	20	0	20	0	0	23	0	100	0	100	.....	.....
	Autumn	25	12	25	12	14	43	25	50	.....	.....	.....	.....
	Winter	32	5	21	14	20	50	40	60	100	0	.....	.....
	Annual	21	13	15	15	10	43	18	53	33	67	.....	.....
Means	Spring	32	10	50	15	58	20	56	20	38	50	0	100
	Summer	24	12	41	19	42	27	48	23	33	33	.....	.....
	Autumn	42	5	59	8	57	16	62	21	62	19	100	0
	Winter	38	10	55	14	58	26	67	27	67	33	50	50
	Annual	35	9	52	13	55	21	60	23	58	30	50	50

TABLE 14e.—*Average percentage frequency of clockwise (cw.) and counter-clockwise (ccw.) turning of winds from surface direction at Leesburg, Ga.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 500 cw.	500 ccw.	1,000 cw.	1,000 ccw.	2,000 cw.	2,000 ccw.	3,000 cw.	3,000 ccw.	4,000 cw.	4,000 ccw.	5,000 cw.	5,000 ccw.
N	Spring	0	25	0	0	.....	.....	.....	.....	.....	.....	.....	.....
	Summer	0	0	0	0	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	0	0	0	50	0	50	0	0	.....	.....
	Winter	33	33	33	0	0	100	0	100	0	100	0	100
	Annual	10	20	12	0	0	75	0	75	0	50	0	100
NNE	Spring	0	40	0	100	.....	.....	.....	.....	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	0	0	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	50	0	33	0	50	0	0	0	.....	.....	.....	.....
	Annual	18	18	17	33	50	0	0	0	.....	.....	.....	.....
NE	Spring	25	50	33	33	0	100	.....	.....	.....	.....	.....	.....
	Summer	0	0	0	0	0	0	.....	.....	.....	.....	.....	.....
	Autumn	20	0	40	0	33	0	50	0	.....	.....	.....	.....
	Winter	80	20	80	20	0	100	.....	.....	.....	.....	.....	.....
	Annual	38	19	50	14	17	33	50	0	.....	.....	.....	.....
ENE	Spring	20	0	50	0	50	50	50	50	.....	.....	.....	.....
	Summer	67	0	67	0	40	0	50	0	100	0	.....	.....
	Autumn	33	17	33	17	0	0	0	0	.....	.....	.....	.....
	Winter	50	0	50	0	33	33	0	0	.....	.....	.....	.....
	Annual	43	4	50	5	33	17	33	17	100	0	.....	.....
E	Spring	0	0	67	0	100	0	.....	.....	.....	.....	.....	.....
	Summer	0	8	11	0	28	0	33	0	.....	.....	.....	.....
	Autumn	0	10	30	20	28	28	0	0	.....	.....	.....	.....
	Winter	50	0	100	0	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	3	6	30	9	38	12	20	0	.....	.....	.....	.....
ESE	Spring	29	14	67	0	.....	.....	.....	.....	.....	.....	.....	.....
	Summer	25	25	33	0	50	0	50	0	.....	.....	.....	.....
	Autumn	0	0	100	0	100	0	100	0	100	0	.....	.....
	Winter	0	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	20	13	62	0	75	0	75	0	100	0	.....	.....
SE	Spring	40	0	100	0	100	0	100	0	100	0	100	0
	Summer	50	0	100	0	100	0	100	0	.....	.....	.....	.....
	Autumn	0	0	0	0	0	0	.....	.....	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Annual	27	0	71	0	71	0	100	0	100	0	100	0
SSE	Spring	25	25	57	30	100	0	100	0	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	33	0	100	0	100	0	.....	.....	.....	.....	.....	.....
	Winter	100	0	100	0	100	0	100	0	100	0	.....	.....
	Annual	43	14	70	20	100	0	100	0	100	0	.....	.....
S	Spring	27	0	64	0	85	0	100	0	100	0	100	0
	Summer	0	0	50	50	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	100	0	100	0	100	0	.....	.....	.....	.....
	Winter	30	10	78	0	100	0	100	0	.....	.....	.....	.....
	Annual	23	4	72	4	95	0	100	0	100	0	100	0
SSW	Spring	17	8	33	11	67	0	100	0	.....	.....	.....	.....
	Summer	0	0	0	0	0	0	0	0	.....	.....	.....	.....
	Autumn	0	33	0	0	100	0	100	0	100	0	.....	.....
	Winter	40	0	75	0	100	0	100	0	.....	.....	.....	.....
	Annual	17	9	38	6	67	0	83	0	100	0	.....	.....
SW	Spring	67	17	50	0	100	0	100	0	.....	.....	.....	.....
	Summer	0	40	0	67	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	0	0	0	0	0	0	0	0	.....	.....
	Winter	71	0	67	0	80	0	100	0	100	0	.....	.....
	Annual	47	16	44	12	80	0	89	0	67	0	.....	.....
WSW	Spring	0	100	0	100	0	0	.....	.....	.....	.....	.....	.....
	Summer	0	33	0	50	0	0	0	0	0	100	.....	.....
	Autumn	50	0	50	0	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	22	0	57	0	71	0	100	0	100	0	.....	.....
	Annual	20	13	42	17	56	0	83	0	50	50	.....	.....
W	Spring	0	0	50	0	0	0	100	0	.....	.....	.....	.....
	Summer	0	11	17	33	20	40	25	50	0	100	.....	.....
	Autumn	0	0	0	0	0	0	0	0	.....	.....	.....	.....
	Winter	14	14	50	25	67	33	100	0	.....	.....	.....	.....
	Annual	5	11	31	23	30	30	50	25	0	100	.....	.....
WNW	Spring	9	27	18	37	14	71	20	60	33	67	.....	.....
	Summer	50	0	50	0	100	0	.....	.....	.....	.....	.....	.....
	Autumn	0	100	0	0	0	0	0	0	0	100	.....	.....
	Winter	38	0	50	0	50	12	40	20	.....	.....	.....	.....
	Annual	23	18	32	18	35	35	27	36	25	75	.....	.....
NW	Spring	0	17	20	20	33	67	50	50	100	0	.....	.....
	Summer	0	50	0	100	0	100	0	100	.....	.....	.....	.....
	Autumn	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	14	0	14	28	14	57	0	75	.....	.....	.....	.....
	Annual	7	13	15	31	18	64	14	71	100	0	.....	.....
NNW	Spring	0	67	33	67	0	100	0	100	0	100	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	33	0	33	67	33	67	0	100	0	100
	Winter	0	0	0	33	0	67	0	100	0	100	.....	.....
	Annual	0	22	22	33	12	75	14	86	0	100	0	100
Means	Spring	19	18	43	19	57	30	68	28	62	38	100	0
	Summer	13	13	28	18	35	12	33	20	20	30	.....	.....
	Autumn	10	8	36	7	37	17	42	16	43	29	0	100
	Winter	39	5	55	8	58	22	65	22	67	33	0	100
	Annual	22	11	42	13	49	21	56	22	54	38	50	50

TABLE 14f.—*Average percentage frequency of clockwise (cw.) and counter-clockwise (ccw.) turning of winds from surface direction at Royal Center, Ind.*

Surface direction.	Season.	Altitude above m. s. l. (meters). 500 cw.	500 ccw.	1,000 cw.	1,000 ccw.	2,000 cw.	2,000 ccw.	3,000 cw.	3,000 ccw.	4,000 cw.	4,000 ccw.	5,000 cw.	5,000 ccw.
N	Spring	0	25	25	50	25	75	100	0	.....	.....	.....	.....
	Summer	33	0	56	0	29	43	50	50	.....	.....	.....	.....
	Autumn	0	0	0	0	33	33	0	100	.....	.....	.....	.....
	Winter	100	0	100	0	0	0	.....	.....	.....	.....	.....	.....
	Annual	24	6	41	12	27	47	50	50	.....	.....	.....	.....
NNE	Spring	14	0	14	14	20	80	25	75	.....	.....	.....	.....
	Summer	0	0	0	20	0	20	0	50	.....	.....	.....	.....
	Autumn	18	18	22	33	0	80	0	75	0	100	.....	.....
	Winter	0	0	0	33	0	100	.....	.....	.....	.....	.....	.....
	Annual	11	7	12	25	6	65	10	70	0	100	.....	.....
NE	Spring	0	0	25	25	25	25	0	100	.....	.....	.....	.....
	Summer	25	25	50	25	33	33	100	0	.....	.....	.....	.....
	Autumn	40	0	50	0	50	50	0	100	.....	.....	.....	.....
	Winter	0	0	0	33	0	100	0	100	.....	.....	.....	.....
	Annual	18	6	33	20	27	45	25	75	.....	.....	.....	.....
ENE	Spring	0	25	0	0	0	50	0	50	.....	.....	.....	.....
	Summer	33	0	33	0	100	0	0	100	.....	.....	.....	.....
	Autumn	0	0	0	0	.....	.....	.....	.....	.....	.....	.....	.....
	Winter	12	0	29	14	50	0	50	0	.....	.....	.....	.....
	Annual	12	6	20	7	40	20	20	40	.....	.....	.....	.....
E	Spring	14	7	50	14	33	33	33	33	0	50	.....	.....
	Summer	44	11	33	33	0	67	0	0	.....	.....	.....	.....
	Autumn	14	14	0	0	25	0	.....	.....	.....	.....	.....	.....
	Winter	33	0	50	33	50	50	50	50	.....	.....	.....	.....
	Annual	25	8	39	19	28	33	33	33	0	50	.....	.....
ESE	Spring	0	0	25	25	33	67	0	100	.....	.....	.....	.....
	Summer	20	0	100	0	100	0	33	0	.....	.....	.....	.....
	Autumn	88	12	86	14	100	0	100	0	.....	.....	.....	.....
	Winter	20	0	40	40	100	0	100	0	.....	.....	.....	.....
	Annual	39	4	63	21	87	13	86	14	.....	.....	.....	.....
SE	Spring	29	0	50	33	50	0	100	0	.....	.....	.....	.....
	Summer	50	0	80	0	100	0	100	0	.....	.....	.....	.....
	Autumn	33	8	70	10	100	0	100	0	100	0	.....	.....
	Winter	89	0	89	0	100	0	100	0	.....	.....	.....	.....
	Annual	50	3	73	10	92	0	100	0	100	0	.....	.....
SSE	Spring	78	0	89	0	100	0	100	0	100	0	.....	.....
	Summer	33	0	25	0	100	0	100	0	.....	.....	.....	.....
	Autumn	40	0	70	0	67	0	75	0	.....	.....	.....	.....
	Winter	62	0	94	0	100	0	100	0	100	0	.....	.....
	Annual	56	0	79	0	93	0	94	0	100	0	.....	.....
S	Spring	83	0	83	0	90	0	80	0	100	0	100	0
	Summer	44	0	75	0	67	17	100	0	.....	.....	.....	.....
	Autumn	50	0	81	0	92	0	100	0	100	0	.....	.....
	Winter	60	0	60	0	100	0	100	0	100	0	.....	.....
	Annual	59	0	78	0	88	3	95	0	100	0	100	0
SSW	Spring	62	0	100	0	100	0	86	14	100	0	.....	.....
	Summer	25	0	64	0	100	0	88	0	50	0	.....	.....
	Autumn	39	4	68	0	89	0	87	0	100	0	.....	.....
	Winter	33	0	75	0	80	0	100	0	100	0	.....	.....
	Annual	38	2	74	0	91	0	88	3	80	0	.....	.....
SW	Spring	40	10	50	0	57	0	75	0	100	0	.....	.....
	Summer	32	0	53	5	62	0	50	0	33	0	.....	.....
	Autumn	25	0	52	4	62	0	80	7	100	0	.....	.....
	Winter	48	0	74	0	88	0	80	0	.....	.....	.....	.....
	Annual	35	1	57	3	68	0	72	3	71	0	.....	.....
WSW	Spring	10	10	30	10	50	25	60	20	0	100	.....	.....
	Summer	4	4	35	9	33	24	40	33	50	0	.....	.....
	Autumn	12	0	56	0	83	0	70	0	100	0	.....	.....
	Winter	20	0	53	7	57	14	44	33	.....	.....	.....	.....
	Annual	11	3	44	6	53	16	51	23	60	20	.....	.....
W	Spring	12	6	29	7	25	17	38	12	67	0	.....	.....
	Summer	20	7	21	21	33	25	12	38	50	0	.....	.....
	Autumn	14	5	35	5	31	25	43	14	100	0	.....	.....
	Winter	37	3	50	0	61	7	44	6	0	100	.....	.....
	Annual	24	4	38	6	43	15	36	15	58	14	.....	.....
WNW	Spring	0	0	25	0	67	0	50	0	100	0	.....	.....
	Summer	20	0	20	0	25	50	33	33	.....	.....	.....	.....
	Autumn	10	5	40	10	53	29	25	62	0	100	.....	.....
	Winter	7	29	14	36	11	44	0	40	0	50	.....	.....
	Annual	9	12	28	16	39	33	22	44	20	60	.....	.....
NW	Spring	0	20	40	20	25	25	0	50	.....	.....	.....	.....
	Summer	17	0	20	20	40	40	33	67	0	100	.....	.....
	Autumn	20	0	30	10	22	33	0	50	.....	.....	.....	.....
	Winter	0	0	33	33	0	50	0	50	.....	.....	.....	.....
	Annual	12	4	30	17	25	35	11	56	0	100	.....	.....
NNW	Spring	0	0	0	60	25	50	0	50	0	100	.....	.....
	Summer	17	0	33	50	20	60	0	50	.....	.....	.....	.....
	Autumn	33	0	33	0	100	0	100	0	.....	.....	.....	.....
	Winter	20	0	20	20	0	67	0	0	.....	.....	.....	.....
	Annual	16	0	21	37	29	50	10	40	0	100	.....	.....
Means	Spring	27	6	46	12	51	23	52	24	67	20	100	0
	Summer	25	3	43	11	48	22	44	26	40	10	.....	.....
	Autumn	28	4	51	5	62	13	68	16	81	19	.....	.....
	Winter	36	3	55	9	65	14	57	15	57	29	.....	.....
	Annual	29	4	49	9	57	17	56	20	65	19	100	0

TABLE 15a.—*Average percentage frequency of clockwise (cw.) and counter-clockwise (ccw.) turning of winds from surface direction at three northern stations—Drexel, Ellendale, and Royal Center.*

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).									
	500		1,000		2,000		3,000		4,000	
	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.
N	12	1	35	13	23	50	23	69	0	88
NNE	2	6	12	28	12	51	18	59	0	100
NE	14	8	35	18	42	35	63	21	14	36
ENE	18	0	42	7	69	14	12	88	100	0
E	22	4	47	23	48	26	67	0	100	0
ESE	11	0	72	3	89	4	67	0	.....	.....
SE	22	0	59	2	86	5	92	0	84	0
SSE	16	0	45	3	90	3	94	2	92	0
S	18	1	54	3	74	13	88	9	78	11
SSW	12	[2]0	48	5	73	5	76	5	65	6
SW	16	1	40	5	70	7	68	8	67	11
WSW	15	12	38	14	53	29	48	35	50	25
W	7	2	43	7	55	17	35	38	39	28
WNW	11	5	28	10	37	33	37	37	56	25
NW	6	0	22	16	28	34	15	57	9	64
NNW	7	0	21	29	13	53	2	55	5	60
Means	12	2	40	10	53	22	49	29	47	24

Winter.

N	40	2	58	16	19	37	2	94	0	75
NNE	5	2	34	29	26	70	25	75	.....	.....
NE	3	3	42	15	50	42	0	67	.....	.....
ENE	8	0	63	5	83	0	75	0	.....	.....
E	39	4	64	11	78	17	78	17	100	0
ESE	22	0	80	13	100	0	100	0	100	0
SE	48	0	96	0	100	0	100	0	100	0
SSE	29	0	93	0	100	0	100	0	100	0
S	30	0	72	0	95	1	96	0	94	0
SSW	27	1	83	0	90	0	100	0	100	0
SW	32	0	76	3	95	0	92	0	88	0
WSW	23	0	70	4	83	6	78	11	88	0
W	23	1	69	1	80	5	71	5	57	36
WNW	6	10	43	14	43	24	26	24	15	48
NW	3	0	32	15	18	35	7	47	18	62
NNW	8	[2]0	20	15	12	52	6	45	0	93
Means	20	1	56	8	63	18	56	23	58	28

Annual.

N	11	3	36	16	26	48	25	68	7	76
NNE	7	5	30	22	27	53	20	66	11	89
NE	10	3	37	16	41	36	29	55	18	57
ENE	10	2	47	6	63	16	65	21	100	0
E	22	3	51	14	61	19	71	16	67	17
ESE	21	2	69	9	88	7	92	5	100	0
SE	26	1	65	6	88	3	95	1	91	0
SSE	25	1	68	2	88	4	95	2	98	0
S	24	1	60	3	81	5	87	6	89	5
SSW	19	1	62	3	82	3	86	3	83	3
SW	20	1	54	5	75	2	80	3	81	4
WSW	14	2	59	5	72	13	75	11	81	9
W	14	1	55	9	63	11	57	17	57	19
WNW	7	6	41	10	47	24	32	37	29	40
NW	6	2	29	11	24	30	12	51	9	70
NNW	6	[2]0	22	23	24	43	11	53	10	80
Means	15	2	48	9	58	18	56	25	60	26

[1] Average surface altitude, 350 m. above m. s. l.
[2] Less than 0.5 per cent.

TABLE 15b.—*Average percentage frequency of clockwise (cw.) and counter-clockwise (ccw.) turning of winds from surface direction at three southern stations—Broken Arrow, Groesbeck, and Leesburg.*

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).									
	500		1,000		2,000		3,000		4,000	
	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.
N	17	0	28	0	0	0	.....	.....	.....	.....
NNE	50	8	65	0	50	0	.....	.....	.....	.....
NE	17	6	26	7	4	21	.....	.....	.....	.....
ENE	34	0	34	0	40	0	50	0	100	0
E	36	14	48	11	43	0	33	0	.....	.....
ESE	57	11	68	3	72	0	83	0	.....	.....
SE	48	15	86	14	83	8	100	0	100	0
SSE	19	2	48	8	70	10	79	6	50	0
S	20	3	55	22	65	14	70	0	100	0
SSW	12	2	25	6	32	10	28	21	0	50
SW	9	23	18	39	10	44	25	29	.....	.....
WSW	20	18	38	26	40	7	33	0	0	100
W	0	6	8	16	10	45	25	50	0	100
WNW	33	0	83	0	100	0	0	0	.....	.....
NW	0	50	0	100	0	100	0	100	.....	.....
NNW	22	0	22	0	0	62	0	50	0	100
Means	21	10	40	14	45	17	49	19	40	27

Winter.

N	26	15	36	14	11	76	0	84	0	100
NNE	40	10	40	15	41	23	16	25	33	67
NE	52	17	66	21	0	100	0	100	.....	.....
ENE	25	50	25	50	33	33	0	0	.....	.....
E	62	0	100	0	.....	.....	.....	.....	.....	.....
ESE	24	0	100	0	100	0	100	0	100	0
SE	84	0	100	0	100	0	100	0	.....	.....
SSE	95	0	100	0	100	0	100	0	100	0
S	36	6	81	0	94	0	98	0	100	0
SSW	35	4	59	3	82	0	87	0	100	0
SW	52	6	70	9	84	4	100	0	100	0
WSW	32	17	58	28	60	25	100	0	100	0
W	14	5	47	8	59	18	50	17	100	0
WNW	38	4	64	5	64	14	63	23	0	100
NW	8	12	22	27	23	44	8	54	0	100
NNW	11	6	12	20	7	61	13	87	50	50
Means	37	7	58	10	59	22	63	23	71	29

Annual.

N	20	11	31	10	10	61	2	74	6	78
NNE	27	14	35	24	39	25	24	37	62	31
NE	32	12	48	12	22	36	39	44	25	50
ENE	35	7	50	12	61	18	16	58	100	0
E	46	7	59	10	63	4	60	0	.....	.....
ESE	42	5	76	2	80	8	89	3	100	0
SE	47	7	81	3	85	2	94	4	100	0
SSE	46	5	73	8	93	2	95	1	93	0
S	27	4	64	3	82	3	89	1	100	0
SSW	20	6	41	6	64	5	71	10	70	12
SW	34	14	48	17	62	14	80	9	62	7
WSW	21	12	44	28	53	21	72	6	25	25
W	17	6	38	12	44	21	50	25	50	50
WNW	33	13	55	15	53	23	42	25	12	88
NW	8	12	25	30	28	30	19	51	44	56
NNW	9	15	18	21	10	61	11	66	11	89
Means	28	8	49	11	56	19	62	20	64	29

[1] Average surface altitude, 150 m. above m. s. l.

TABLE 15c.—*Average percentage frequency of clockwise (cw.) and counterclockwise (ccw.) turning of winds from surface direction at all six stations.*

Summer.

Surface direction.[1]	Altitude above m. s. l. (meters).									
	500		1,000		2,000		3,000		4,000	
	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.
N	14	[2] 0	31	6	18	38	23	69	0	88
NNE	21	7	33	17	27	30	18	59	0	100
NE	16	7	30	12	23	28	63	21	14	36
ENE	24	0	39	4	62	10	25	58	100	0
E	29	9	47	17	46	13	58	0	100	0
ESE	34	6	70	3	81	2	75	0	.....	.....
SE	35	8	72	8	85	7	95	0	89	0
SSE	17	1	46	5	82	6	88	4	71	0
S	19	2	54	12	70	14	81	5	89	6
SSW	12	1	37	6	53	7	52	13	49	17
SW	12	12	29	22	46	22	51	16	67	11
WSW	18	15	38	20	47	18	41	17	33	50
W	4	4	29	11	37	28	33	41	29	46
WNW	22	2	56	5	68	17	28	28	56	25
NW	4	12	16	37	21	51	12	68	9	64
NNW	13	0	22	17	8	56	1	66	3	73
Means	17	6	40	12	49	20	49	24	43	25

Winter.

N	33	8	47	15	15	57	1	88	0	88
NNE	13	6	37	22	34	47	21	50	33	67
NE	28	10	54	18	25	71	0	75	.....	.....
ENE	15	20	48	23	71	8	50	0	.....	.....
E	48	2	78	7	78	17	78	17	100	0
ESE	23	0	88	8	100	0	100	0	100	0
SE	62	0	97	0	100	0	100	0	100	0
SSE	59	0	97	0	100	0	100	0	100	0

[1] Average surface altitude, 250 m. above m. s. l.
[2] Less than 0.5 per cent.

TABLE 15c.—*Average percentage frequency of clockwise (cw.) and counterclockwise (ccw.) turning of winds from surface direction at all six stations*—Continued.

Winter—Continued.

Surface direction.	Altitude above m. s. l. (meters).									
	500		1,000		2,000		3,000		4,000	
	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.	cw.	ccw.
S	33	3	76	0	94	1	97	0	97	0
SSW	31	2	71	2	86	0	93	0	100	0
SW	42	3	73	6	90	2	96	0	95	0
WSW	28	8	64	16	74	14	84	8	91	0
W	18	3	58	5	60	11	60	11	68	27
WNW	22	7	54	10	54	19	45	24	11	61
NW	5	6	27	21	21	40	8	50	9	81
NNW	9	3	16	18	9	57	10	66	25	72
Means	28	4	57	9	61	20	60	23	65	28

Annual.

N	16	7	34	13	18	55	14	71	6	77
NNE	17	10	33	23	33	39	22	52	32	67
NE	21	7	42	14	31	36	34	50	22	54
ENE	23	5	49	9	62	17	46	36	100	0
E	34	5	55	12	62	12	66	10	67	17
ESE	32	4	72	5	84	8	90	4	100	0
SE	36	4	73	5	86	2	94	2	96	0
SSE	36	3	70	5	90	3	95	2	96	0
S	26	2	62	3	82	4	88	3	95	3
SSW	19	4	52	5	73	4	78	6	65	8
SW	27	7	51	11	69	8	80	6	82	6
WSW	18	7	51	16	62	17	74	8	59	16
W	15	4	46	10	53	16	54	21	54	31
WNW	20	9	48	12	50	24	37	31	23	65
NW	7	7	27	20	26	30	16	51	27	63
NNW	8	8	20	22	17	52	11	60	11	84
Means	22	5	49	10	57	18	59	22	62	27

TABLE 16a.—*Average percentage frequency of a west component in winds at various levels at Broken Arrow, Okla.*

Surface direction	Season.	Altitude above m. s. l. (meters).						
		233	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	50	36	25	40	0	.....	.....
	Summer	50	50	25	50	.....	.....	.....
	Autumn	50	42	27	70	100	100	.....
	Winter	50	41	39	78	100	.....	.....
	Annual	50	41	31	65	83	100	.....
NNE.	Spring	0	8	27	22	67	100	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	0	0	12	33	.....	.....
	Winter	0	0	8	40	.....	.....	.....
	Annual	0	2	9	21	50	100	.....
NE.	Spring	0	0	0	0	0	.....	.....
	Summer	0	9	10	25	.....	.....	.....
	Autumn	0	0	0	0	0	0	.....
	Winter	0	0	0	100	100	.....	.....
	Annual	0	3	3	16	17	0	.....
ENE.	Spring	0	0	0	0	.....	.....	.....
	Summer	0	0	0	.....	.....	.....	.....
	Autumn	0	0	0	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....
	Annual	0	0	0	0	.....	.....	.....
E.	Spring	0	0	0	33	.....	.....	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	0	0	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....
	Annual	0	0	0	25	.....	.....	.....
ESE.	Spring	0	0	0	50	100	100	.....
	Summer	0	0	50	100	100	.....	.....
	Autumn	0	0	0	.....	.....	.....	.....
	Winter	0	0	0	0	.....	.....	.....
	Annual	0	0	25	60	100	100	.....
SE.	Spring	0	0	15	78	33	.....	.....
	Summer	0	12	62	67	67	100	.....
	Autumn	0	0	38	83	100	100	100
	Winter	0	0	0	0	.....	.....	.....
	Annual	0	3	31	73	62	100	100
SSE.	Spring	0	26	63	83	100	100	.....
	Summer	0	5	33	62	67	100	.....
	Autumn	0	20	48	79	100	100	100
	Winter	0	57	92	75	100	.....	.....
	Annual	0	24	55	75	92	100	100
S.	Spring	50	61	83	97	100	100	.....
	Summer	50	67	79	84	91	100	.....
	Autumn	50	58	69	85	85	100	.....
	Winter	50	62	90	100	100	100	.....
	Annual	50	61	78	90	92	100	.....
SSW.	Spring	100	92	92	100	100	100	.....
	Summer	100	100	100	100	85	100	.....
	Autumn	100	100	100	100	86	.....	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	99	99	100	90	100	.....
SW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	88	100	.....	.....
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	97	100	100	100
WSW.	Spring	100	100	100	100	.....	.....	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	100	.....	.....	.....
	Winter	100	100	100	100	.....	.....	.....
	Annual	100	100	100	100	100	.....	.....
W.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	.....	.....
WNW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	.....	.....	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	.....	.....
NW.	Spring	100	100	100	100	100	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
NNW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	100	.....	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
Means.	Spring	45	50	63	80	89	100	.....
	Summer	51	58	68	76	85	100	.....
	Autumn	46	51	58	79	84	93	100
	Winter	58	64	74	87	100	100	100
	Annual	49	55	65	80	88	97	100

TABLE 16b.—*Average percentage frequency of a west component in winds at various levels at Drexel, Nebr.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		396	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	50	48	54	65	78	100	.....
	Summer	50	55	62	75	88	100	100
	Autumn	50	51	55	71	92	91	100
	Winter	50	55	57	83	96	100	.....
	Annual	50	52	57	74	88	96	100
NNE.	Spring	0	0	13	38	70	80	100
	Summer	0	6	35	73	86	100	.....
	Autumn	0	0	7	36	100	100	100
	Winter	0	0	15	24	67	.....	.....
	Annual	0	1	16	40	75	89	100
NE.	Spring	0	0	0	20	20	0	.....
	Summer	0	0	0	33	77	86	.....
	Autumn	0	0	0	33	67	0	.....
	Winter	0	0	11	25	100	.....	.....
	Annual	0	0	1	28	58	55	.....
ENE.	Spring	0	0	4	8	25	0	.....
	Summer	0	0	0	17	50	100	.....
	Autumn	0	0	0	0	50	.....	.....
	Winter	0	0	0	42	71	.....	.....
	Annual	0	0	2	20	53	67	.....
E.	Spring	0	0	0	0	43	100	100
	Summer	0	0	0	33	100	100	.....
	Autumn	0	0	0	11	50	.....	.....
	Winter	0	0	0	33	50	100	.....
	Annual	0	0	0	17	55	100	100
ESE.	Spring	0	0	0	23	38	0	.....
	Summer	0	0	0	59	100	.....	.....
	Autumn	0	0	0	43	80	100	100
	Winter	0	0	22	83	100	100	.....
	Annual	0	0	3	47	70	88	100
SE.	Spring	0	0	13	38	64	78	.....
	Summer	0	0	15	58	85	100	.....
	Autumn	0	0	36	62	67	100	.....
	Winter	0	0	53	88	100	100	100
	Annual	0	0	23	56	76	89	100
SSE.	Spring	0	2	29	64	91	100	100
	Summer	0	8	30	75	83	85	67
	Autumn	0	9	51	71	89	89	100
	Winter	0	11	73	100	100	100	.....
	Annual	0	7	47	76	90	91	80
S.	Spring	50	53	76	92	100	100	.....
	Summer	50	54	75	88	96	89	.....
	Autumn	50	52	77	90	89	95	100
	Winter	50	56	94	96	100	100	.....
	Annual	50	53	79	91	95	96	100
SSW.	Spring	100	100	92	100	100	100	100
	Summer	100	100	94	94	94	92	100
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	100	100	100	100	100
	Annual	100	100	97	98	98	97	100
SW.	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	97	100	100	.....
	Autumn	100	100	100	97	96	90	.....
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	98	99	97	100
WSW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	88	50	.....
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	100	98	96	100
W.	Spring	100	100	100	92	100	100	100
	Summer	100	100	100	100	100	100	100
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	98	100	100	100
WNW.	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	100	100	100	100
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	100	100	100	100
NW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	100
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	98	100	100	100	.....
	Annual	100	100	99	100	100	100	100
NNW.	Spring	100	100	96	97	100	100	100
	Summer	100	100	96	92	100	100	100
	Autumn	100	98	93	94	97	94	100
	Winter	100	100	94	97	100	100	100
	Annual	100	99	94	96	99	98	100
Means.	Spring	49	49	55	70	84	90	100
	Summer	50	52	59	80	92	93	92
	Autumn	61	62	71	83	92	95	100
	Winter	66	68	79	91	97	100	100
	Annual	57	58	66	81	92	95	98

TABLE 16c.—*Average percentage frequency of a west component in winds at various levels at Ellendale, N. Dak.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		444	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	50	48	29	45	67	67	0
	Summer	50	46	37	65	80	100	100
	Autumn	50	41	20	60	83	100	.....
	Winter	50	46	29	53	100	100	.....
	Annual	50	45	28	55	79	90	50
NNE.	Spring	0	0	0	20	33	67	.....
	Summer	0	0	11	33	40	100	.....
	Autumn	0	0	5	10	25	50	.....
	Winter	0	0	19	86	100	.....	.....
	Annual	0	0	8	33	52	67	.....
NE.	Spring	0	0	12	20	100	100	.....
	Summer	0	0	0	0	0	0	.....
	Autumn	0	0	0	0	50	.....	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	0	2	4	33	50	.....
ENE.	Spring	0	0	0	0	0	0	.....
	Summer	0	0	0	25	.....	.....	.....
	Autumn	0	0	0	0	50	100	.....
	Winter	0	0	0	0	.....	.....	.....
	Annual	0	0	0	5	14	33	.....
E.	Spring	0	0	0	0	100	.....	.....
	Summer	0	0	0	0	100	100	.....
	Autumn	0	0	17	33	60	0	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	0	4	11	67	33	.....
ESE.	Spring	0	0	12	40	100	.....	.....
	Summer	0	0	0	11	33	.....	.....
	Autumn	0	0	0	43	75	50	100
	Winter	0	0	20	100	100	100	100
	Annual	0	0	6	42	73	75	100
SE.	Spring	0	0	10	30	80	100	.....
	Summer	0	0	0	29	50	67	100
	Autumn	0	0	27	70	83	100	.....
	Winter	0	0	20	100	100	.....	.....
	Annual	0	0	11	49	76	80	100
SSE.	Spring	0	0	21	38	57	100	.....
	Summer	0	0	29	75	88	100	100
	Autumn	0	0	47	92	100	100	100
	Winter	0	0	86	100	100	.....	.....
	Annual	0	0	38	72	85	100	100
S.	Spring	50	52	65	68	72	67	100
	Summer	50	51	64	81	77	89	100
	Autumn	50	57	79	96	100	100	100
	Winter	50	59	86	94	100	83	.....
	Annual	50	54	71	82	83	86	100
SSW.	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	94	100	100	.....
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	98	100	100	100
SW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	100	100	100	100
WSW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	67	67	67	.....	.....
	Autumn	100	100	100	92	100	100	100
	Winter	100	100	100	100	100	100	100
	Annual	100	100	96	92	95	100	100
W.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	100
WNW.	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	100	100	100	100
	Autumn	100	100	100	96	100	100	100
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	98	100	100	100
NW.	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	94	100	100	100
	Autumn	100	100	97	96	100	100	.....
	Winter	100	100	95	94	100	100	100
	Annual	100	100	98	96	100	100	100
NNW.	Spring	100	100	78	65	75	50	50
	Summer	100	100	88	100	100	100	100
	Autumn	100	100	72	86	88	100	.....
	Winter	100	100	86	86	92	100	100
	Annual	100	100	82	83	88	88	75
Means.	Spring	53	53	54	63	78	77	71
	Summer	48	48	51	71	83	94	100
	Autumn	56	56	58	74	88	86	87
	Winter	70	71	73	87	97	98	100
	Annual	56	56	59	74	92	94	91

TABLE 16d.—*Average percentage frequency of a west component in winds at various levels at Groesbeck, Tex.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		141	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	50	60	67	100	100	.....	.....
	Summer	50	25	33	.....	.....	.....	.....
	Autumn	50	33	29	80	86	67	.....
	Winter	50	39	41	79	100	100	100
	Annual	50	39	40	81	93	83	100
NNE.	Spring	0	14	14	55	100	100	100
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	4	6	25	50	0	.....
	Winter	0	11	12	33	50	67	100
	Annual	0	9	10	36	61	62	100
NE.	Spring	0	0	0	50	100	.....	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	0	0	0	0	0	0
	Winter	0	11	0	100	.....	.....	.....
	Annual	0	4	0	22	25	0	0
ENE.	Spring	0	0	0	40	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	0	0	0	.....	.....
	Winter	0	0	0	.....	.....	.....	.....
	Annual	0	0	0	25	0	.....	.....
E.	Spring	0	0	0	100	.....	.....	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	0	0	33	100	.....	.....
	Winter	0	0	0	.....	.....	.....	.....
	Annual	0	0	0	50	100	.....	.....
ESE.	Spring	0	0	9	29	0	.....	.....
	Summer	0	9	10	0	0	.....	.....
	Autumn	0	0	14	25	33	.....	.....
	Winter	0	0	14	50	67	100	.....
	Annual	0	2	11	30	45	100	.....
SE.	Spring	0	0	18	44	60	.....	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	12	35	61	60	100	.....
	Winter	0	25	71	83	100	.....	.....
	Annual	0	9	31	54	62	100	.....
SSE.	Spring	0	32	61	85	80	100	.....
	Summer	0	18	25	40	62	0	.....
	Autumn	0	38	68	88	90	100	.....
	Winter	0	75	100	100	100	.....	.....
	Annual	0	33	57	77	79	80	.....
S.	Spring	50	62	77	85	93	100	.....
	Summer	50	59	73	67	83	100	.....
	Autumn	50	67	78	80	95	100	100
	Winter	50	74	96	94	100	100	.....
	Annual	50	65	81	83	94	100	100
SSW.	Spring	100	96	92	89	100	100	.....
	Summer	100	97	92	90	78	.....	.....
	Autumn	100	100	100	100	94	100	.....
	Winter	100	96	96	100	100	100	100
	Annual	100	97	95	95	94	100	100
SW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	100	100	100	100
WSW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	.....	.....	.....	.....
	Annual	100	100	100	100	100	100	.....
W.	Spring	100	100	.....	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	100	100	100	.....	.....	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
WNW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
NW.	Spring	100	100	100	100	100	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
NNW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	88	88	100	100	.....	.....
	Winter	100	84	86	90	80	100	.....
	Annual	100	91	92	97	94	100	.....
Means.	Spring	48	54	62	79	92	100	100
	Summer	58	61	64	71	77	67	.....
	Autumn	39	45	55	74	81	76	50
	Winter	60	62	70	87	92	95	100
	Annual	51	55	62	78	86	87	88

TABLE 16e.—*Average percentage frequency of a west component in winds at various levels at Leesburg, Ga.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		85	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	50	75	50	.....	.....	.....	.....
	Summer	50	100	100	.....	.....	.....	.....
	Autumn	50	50	50	100	100	100	.....
	Winter	50	67	33	100	100	100	100
	Annual	50	70	50	100	100	100	100
NNE.	Spring	0	20	100	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	0	0	.....	.....	.....	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	9	33	0	0	.....	.....
NE.	Spring	0	25	33	0	.....	.....	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	0	0	0	0	.....	.....
	Winter	0	0	20	100	.....	.....	.....
	Annual	0	6	14	17	0	.....	.....
ENE.	Spring	0	0	0	50	50	.....	.....
	Summer	0	0	0	0	0	0	.....
	Autumn	0	0	0	0	0	.....	.....
	Winter	0	0	0	33	0	.....	.....
	Annual	0	0	0	17	17	0	.....
E.	Spring	0	0	0	0	.....	.....	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	0	0	.....	.....
	Winter	0	50	100	.....	.....	.....	.....
	Annual	0	3	4	0	0	.....	.....
ESE.	Spring	0	0	33	.....	.....	.....	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	50	50	100	.....
	Winter	0	0	.....	.....	.....	.....	.....
	Annual	0	0	12	25	25	100	.....
SE.	Spring	0	20	67	100	100	100	100
	Summer	0	0	0	50	100	.....	.....
	Autumn	0	0	0	0	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....
	Annual	0	9	29	57	100	100	100
SSE.	Spring	0	25	30	100	100	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	0	33	100	100	.....	.....	.....
	Winter	0	67	100	100	100	100	.....
	Annual	0	36	50	100	100	100	.....
S.	Spring	50	64	81	100	100	100	100
	Summer	50	50	50	.....	.....	.....	.....
	Autumn	50	67	100	100	100	.....	.....
	Winter	50	60	89	100	100	.....	.....
	Annual	50	62	84	100	100	100	100
SSW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
SW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	.....	.....	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
WSW.	Spring	100	100	100	100	.....	.....	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	.....	.....	.....	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
W.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
WNW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	0	.....	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	94	100	100	.....
NW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	.....	.....	.....	.....	.....	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
NNW.	Spring	100	100	100	100	100	100	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	100	67	67	67	100	100
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	89	88	86	100	100
Means.	Spring	52	58	75	89	96	100	100
	Summer	48	48	44	35	53	60	.....
	Autumn	29	31	33	47	63	100	100
	Winter	66	71	87	92	95	100	100
	Annual	51	55	62	72	82	92	100

TABLE 16f.—*Average percentage frequency of a west component in winds at various levels at Royal Center, Ind.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		225	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	50	75	75	75	0	.....	.....
	Summer	50	33	22	57	50	.....	.....
	Autumn	50	67	67	67	100	.....	.....
	Winter	50	0	0	0	.....	.....	.....
	Annual	50	47	41	60	50	.....	.....
NNE.	Spring	0	0	0	40	50	.....	.....
	Summer	0	0	0	20	50	.....	.....
	Autumn	0	9	22	60	75	100	.....
	Winter	0	0	33	50	.....	.....	.....
	Annual	0	4	12	41	60	100	.....
NE.	Spring	0	0	0	25	100	.....	.....
	Summer	0	0	0	33	100	.....	.....
	Autumn	0	0	0	50	100	.....	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	0	0	27	75	.....	.....
ENE.	Spring	0	0	0	0	0	.....	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	.....	.....	.....	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	0	0	0	0	.....	.....
E.	Spring	0	0	0	11	33	0	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	0	.....	.....	.....
	Winter	0	0	0	0	50	.....	.....
	Annual	0	0	0	6	33	0	.....
ESE.	Spring	0	0	0	0	0	.....	.....
	Summer	0	0	0	23	33	.....	.....
	Autumn	0	0	14	40	100	.....	.....
	Winter	0	0	20	50	67	.....	.....
	Annual	0	0	11	33	71	.....	.....
SE.	Spring	0	0	17	50	100	.....	.....
	Summer	0	12	60	100	100	.....	.....
	Autumn	0	8	29	100	100	100	.....
	Winter	0	0	44	100	100	.....	.....
	Annual	0	6	33	92	100	100	.....
SSE.	Spring	0	44	78	100	100	100	.....
	Summer	0	17	25	100	100	.....	.....
	Autumn	0	20	30	67	75	.....	.....
	Winter	0	38	81	92	100	100	.....
	Annual	0	32	62	89	94	100	.....
S.	Spring	50	92	92	100	100	100	100
	Summer	50	78	88	83	100	.....	.....
	Autumn	50	78	94	100	100	100	.....
	Winter	50	80	100	100	100	100	.....
	Annual	50	82	93	97	100	100	100
SSW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
SW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
WSW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
W.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	86	100	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	97	100	.....
WNW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	100	100	.....
NW.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
NNW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	83	80	100	.....	.....
	Autumn	100	100	100	0	0	.....	.....
	Winter	100	80	80	100	100	.....	.....
	Annual	100	95	89	79	90	100	.....
Means.	Spring	53	61	65	77	85	87	100
	Summer	66	68	73	84	93	100	.....
	Autumn	67	72	78	89	95	100	.....
	Winter	68	71	80	91	92	100	.....
	Annual	64	68	75	85	92	96	100

NOTE.—In Tables 16a to 16f winds recorded exactly "north" or "south" have been considered as having had a westerly component in 50 per cent of the cases.

TABLE 17a.—*Average percentage frequency of a west component in the free-air winds above surface easterly winds at three northern stations—Drexel, Ellendale, and Royal Center.*

Summer.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.[1]	500	1,000	2,000	3,000	4,000
N	50	45	40	66	73	100
NNE	0	2	15	42	59	100
NE	0	0	0	22	59	43
ENE	0	0	0	14	25	100
E	0	0	0	11	67	100
ESE	0	0	0	34	55	.....
SE	0	4	25	62	78	84
SSE	0	8	28	83	90	92
S	50	61	76	84	91	89
Means (all directions)	55	56	61	78	89	96

Winter.

N	50	34	29	45	98	100
NNE	0	0	22	53	84	.....
NE	0	0	4	8	33	.....
ENE	0	0	0	14	36	.....
E	0	0	0	11	33	100
ESE	0	0	21	78	89	100
SE	0	0	39	96	100	100
SSE	0	16	80	97	100	100
S	50	65	93	97	100	94
Means (all directions)	68	70	77	90	95	99

Annual.

N	50	48	42	63	72	93
NNE	0	2	12	38	62	85
NE	0	0	1	20	55	52
ENE	0	0	1	8	22	50
E	0	0	1	11	52	44
ESE	0	0	7	41	71	82
SE	0	2	22	66	84	90
SSE	0	13	49	79	90	97
S	50	63	81	90	93	94
Means (all directions)	59	61	67	80	92	95

[1] Average surface altitude, 350 m. above m. s. l.

TABLE 17b.—*Average percentage frequency of a west component in the free-air winds above surface easterly winds at three southern stations—Broken Arrow, Groesbeck, and Leesburg.*

Summer.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.[1]	500	1,000	2,000	3,000	4,000
N	50	58	53	50	.....	.....
NNE	0	0	0	0	.....	.....
NE	0	3	3	8	.....	.....
ENE	0	0	0	0	0	0
E	0	0	0	0	0	.....
ESE	0	3	20	33	33	.....
SE	0	4	21	39	84	100
SSE	0	12	29	51	64	50
S	50	62	67	76	87	100
Means (all directions)	52	55	59	61	72	76

Winter.

N	50	49	38	86	100	100
NNE	0	4	7	24	25	67
NE	0	4	7	100	100	.....
ENE	0	0	0	33	0	.....
E	0	25	50	.....	.....	.....
ESE	0	0	7	25	34	100

[1] Average surface altitude, 150 m. above m. s. l.

TABLE 17b.—*Average percentage frequency of a west component in the free-air winds above surface easterly winds at three southern stations—Broken Arrow, Groesbeck, and Leesburg*—Continued.

Winter—Continued.

Surface direction.	Altitude above m. s. l. (meters).					
	Suface.	500	1,000	2,000	3,000	4,000
SE	0	12	36	42	100	.....
SSE	0	66	97	92	100	100
S	50	65	92	98	100	100
Means (all directions)	61	66	77	89	96	98

Annual.

N	50	50	27	82	92	94
NNE	0	7	17	19	37	81
NE	0	4	6	18	14	0
ENE	0	0	0	8	17	0
E	0	1	1	12	0	.....
ESE	0	0	17	45	64	100
SE	0	7	30	61	75	100
SSE	0	31	54	84	90	93
S	50	63	81	91	95	100
Means (all directions)	50	55	63	77	85	92

TABLE 17c.—*Average percentage frequency of a west component in the free-air winds above surface easterly winds at all six stations.*

Summer.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.[1]	500	1,000	2,000	3,000	4,000
N	50	52	46	62	73	67
NNE	0	1	9	25	59	100
NE	0	2	2	15	30	43
ENE	0	0	0	10	17	100
E	0	0	0	6	50	100
ESE	0	2	10	34	44	.....
SE	0	6	23	51	82	89
SSE	0	10	28	70	80	71
S	50	62	72	81	89	94
Means (all directions)	54	56	60	70	80	86

Winter.

N	50	41	33	66	99	100
NNE	0	2	14	39	54	67
NE	0	2	5	54	50	.....
ENE	0	0	0	19	24	.....
E	0	10	20	11	33	100
ESE	0	0	15	57	84	100
SE	0	5	38	74	100	100
SSE	0	41	89	94	100	100
S	50	65	92	97	100	97
Means (all directions)	64	68	77	89	96	99

Annual.

N	50	49	31	72	82	94
NNE	0	4	15	28	50	84
NE	0	2	3	19	35	26
ENE	0	0	[2] 0	8	21	33
E	0	[2] 0	1	12	39	44
ESE	0	0	12	43	68	93
SE	0	4	26	64	79	95
SSE	0	22	52	82	90	95
S	50	63	81	90	94	97
Means (all directions)	55	58	65	78	89	94

[1] Average surface altitude, 250 m. above m. s. l. [2] Less than 0.5 per cent.

NOTE.—In Tables 17a to 17c winds recorded exactly "north" or "south" have been considered as having had a westerly component in 50 per cent of the cases.

TABLE 18a.—*Average percentage frequency of a north component in winds at various levels at Broken Arrow, Okla.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		233	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	90	100	100	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	96	100	100	.....
NNE.	Spring	100	100	82	78	33	0	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	94	88	100	.....	.....
	Winter	100	100	92	80	.....	.....	.....
	Annual	100	100	91	83	67	0	.....
NE.	Spring	100	100	88	60	0	.....	.....
	Summer	100	100	100	88	.....	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	97	84	83	100	.....
ENE.	Spring	100	100	0	0	.....	.....	.....
	Summer	100	100	100	.....	.....	.....	.....
	Autumn	100	100	100	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....
	Annual	100	100	40	0	.....	.....	.....
E.	Spring	50	0	0	0	.....	.....	.....
	Summer	50	33	33	0	.....	.....	.....
	Autumn	50	0	0	.....	.....	.....	.....
	Winter	.....	.....	.....	.....	.....	.....	.....
	Annual	50	12	12	0	.....	.....	.....
ESE.	Spring	0	0	0	50	0	0	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	.....	.....	.....	.....
	Winter	0	0	0	0	.....	.....	.....
	Annual	0	0	0	20	0	0	.....
SE.	Spring	0	0	0	0	0	.....	.....
	Summer	0	0	0	0	0	0	.....
	Autumn	0	0	0	0	0	0	0
	Winter	0	0	0	0	.....	.....	.....
	Annual	0	0	0	0	0	0	0
SSE.	Spring	0	0	0	0	0	0	.....
	Summer	0	0	0	0	0	0	.....
	Autumn	0	0	0	0	0	0	0
	Winter	0	0	0	0	50	.....	.....
	Annual	0	0	0	0	4	0	0
S.	Spring	0	0	0	0	6	0	.....
	Summer	0	0	0	4	18	0	.....
	Autumn	0	0	0	0	5	33	.....
	Winter	0	0	0	0	0	0	.....
	Annual	0	0	0	1	8	17	.....
SSW.	Spring	0	0	0	0	29	0	.....
	Summer	0	0	0	5	0	0	.....
	Autumn	0	0	0	6	0	.....	.....
	Winter	0	0	0	20	33	100	.....
	Annual	0	0	0	5	10	40	.....
SW.	Spring	0	0	0	38	100	100	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	11	29	50	67	100
	Winter	0	6	29	71	83	100	100
	Annual	0	2	12	33	59	80	100
WSW.	Spring	0	0	0	0	.....	.....	.....
	Summer	0	0	100	100	100	.....	.....
	Autumn	0	0	0	0	.....	.....	.....
	Winter	0	0	33	0	.....	.....	.....
	Annual	0	0	29	17	100	.....	.....
W.	Spring	50	25	25	67	100	.....	.....
	Summer	50	50	50	0	.....	.....	.....
	Autumn	50	50	50	67	100	.....	.....
	Winter	50	67	67	100	100	.....	.....
	Annual	50	47	47	60	100	.....	.....
WNW.	Spring	100	100	75	75	100	.....	.....
	Summer	100	100	100	100	100	.....	.....
	Autumn	100	100	100	.....	.....	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	92	88	100	.....	.....
NW.	Spring	100	100	100	100	100	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	100	100	100	67	.....	.....
	Winter	100	100	100	100	100	100	.....
	Annual	100	100	100	100	88	100	.....
NNW.	Spring	100	100	100	100	100	100	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	100	.....	.....	.....
	Winter	100	100	100	100	100	.....	.....
	Annual	100	100	100	100	100	100	.....
Means.	Spring	33	31	25	29	32	29	.....
	Summer	21	21	21	18	10	0	.....
	Autumn	33	33	32	28	28	33	25
	Winter	44	44	46	53	69	80	100
	Annual	33	33	31	29	31	33	40

TABLE 18b.—*Average percentage frequency of a north component in winds at various levels at Drexel, Nebr.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		396	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	100	100	100	100	96	80	.....
	Summer	100	100	100	100	100	100	100
	Autumn	100	100	100	97	100	82	100
	Winter	100	100	100	97	96	100	.....
	Annual	100	100	100	98	98	89	100
NNE.	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	91	86	100	.....
	Autumn	100	100	96	86	100	100	100
	Winter	100	100	90	82	67	.....	.....
	Annual	100	100	97	90	86	100	100
NE.	Spring	100	100	93	80	80	100	.....
	Summer	100	100	90	72	62	71	.....
	Autumn	100	100	95	73	89	100	.....
	Winter	100	100	78	50	100	.....	.....
	Annual	100	100	91	74	76	82	.....
ENE.	Spring	100	100	65	38	25	100	.....
	Summer	100	93	80	67	50	0	.....
	Autumn	100	100	86	75	50	.....	.....
	Winter	100	84	29	0	0	.....	.....
	Annual	100	97	63	39	24	33	.....
E.	Spring	50	38	31	27	14	0	0
	Summer	50	37	32	11	0	0	.....
	Autumn	50	33	25	11	0	.....	.....
	Winter	50	33	11	17	17	0	.....
	Annual	50	36	27	17	10	0	0
ESE.	Spring	0	0	0	0	0	0	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	0	0	0	0
	Winter	0	0	0	0	0	0	.....
	Annual	0	0	0	0	0	0	0
SE.	Spring	0	0	2	3	4	11	.....
	Summer	0	0	0	0	15	50	.....
	Autumn	0	0	0	0	0	0	.....
	Winter	0	0	0	12	15	25	100
	Annual	0	0	1	3	8	22	100
SSE.	Spring	0	0	0	0	4	0	0
	Summer	0	0	0	0	4	8	33
	Autumn	0	0	0	0	0	0	0
	Winter	0	0	0	6	35	43	.....
	Annual	0	0	0	1	10	12	20
S.	Spring	0	0	0	6	17	0	.....
	Summer	0	0	0	2	4	0	.....
	Autumn	0	0	0	0	6	16	67
	Winter	0	0	0	7	21	73	.....
	Annual	0	0	0	3	11	25	67
SSW.	Spring	0	0	0	9	18	50	50
	Summer	0	0	0	5	10	15	0
	Autumn	0	0	2	12	32	41	50
	Winter	0	0	2	32	64	100	100
	Annual	0	0	1	13	28	41	50
SW.	Spring	0	0	7	19	35	44	0
	Summer	0	0	0	10	32	50	.....
	Autumn	0	0	12	34	50	40	.....
	Winter	0	0	20	50	50	50	100
	Annual	0	0	10	29	42	45	67
WSW.	Spring	0	12	41	60	75	83	.....
	Summer	0	0	18	40	38	0	.....
	Autumn	0	5	32	50	64	78	100
	Winter	0	14	52	81	78	62	100
	Annual	0	9	39	63	68	68	100
W.	Spring	50	60	60	77	75	80	100
	Summer	50	50	86	83	80	67	100
	Autumn	50	60	80	75	75	100	.....
	Winter	50	62	90	89	96	86	.....
	Annual	50	60	80	84	88	83	100
WNW.	Spring	100	100	100	82	71	80	100
	Summer	100	100	86	79	73	100	100
	Autumn	100	100	100	88	75	72	50
	Winter	100	100	96	88	87	75	100
	Annual	100	100	96	85	79	79	83
NW.	Spring	100	100	100	96	83	75	.....
	Summer	100	100	96	96	95	62	100
	Autumn	100	100	100	98	89	67	50
	Winter	100	100	100	100	97	75	.....
	Annual	100	100	99	98	91	68	67
NNW.	Spring	100	100	100	92	86	86	50
	Summer	100	100	100	96	90	80	50
	Autumn	100	100	100	98	94	65	75
	Winter	100	100	100	98	92	69	50
	Annual	100	100	100	97	91	72	60
Means.	Spring	50	50	49	47	46	57	50
	Summer	37	37	35	35	41	41	58
	Autumn	45	45	47	47	50	50	63
	Winter	55	56	58	63	67	68	90
	Annual	47	47	47	48	52	53	65

TABLE 18c.—*Average percentage frequency of a north component in winds at various levels at Ellendale, N. Dak.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		444	500	1,000	2,000	3,000	4,000	5,000
N	Spring	100	100	100	100	100	100	100
	Summer	100	100	100	100	100	100	100
	Autumn	100	100	100	93	67	100	.....
	Winter	100	100	96	93	100	50	.....
	Annual	100	100	99	97	94	90	100
NNE	Spring	100	100	100	100	100	67	.....
	Summer	100	100	89	92	80	100	.....
	Autumn	100	100	95	80	100	100	.....
	Winter	100	100	88	86	100	.....	.....
	Annual	100	100	93	90	95	83	.....
NE	Spring	100	100	100	100	100	100	.....
	Summer	100	100	85	50	50	100	.....
	Autumn	100	100	73	70	50	.....	.....
	Winter	100	100	67	75	100	.....	.....
	Annual	100	100	81	72	67	100	.....
ENE	Spring	100	100	58	44	40	50	.....
	Summer	100	100	50	25	.....	.....	.....
	Autumn	100	86	29	20	0	0	.....
	Winter	100	100	50	0	.....	.....	.....
	Annual	100	97	48	30	29	33	.....
E	Spring	50	44	22	17	0	.....	.....
	Summer	50	43	20	0	0	0	.....
	Autumn	50	17	17	17	40	0	.....
	Winter	50	25	0	0	0	.....	.....
	Annual	50	35	17	11	22	0	.....
ESE	Spring	0	0	0	0	0	.....	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	0	0	0	0
	Winter	0	0	0	0	33	50	0
	Annual	0	0	0	0	9	25	0
SE	Spring	0	0	0	10	0	0	.....
	Summer	0	0	0	0	0	0	0
	Autumn	0	0	0	0	17	0	.....
	Winter	0	0	0	20	25	.....	.....
	Annual	0	0	0	5	10	0	0
SSE	Spring	0	0	0	0	0	0	.....
	Summer	0	0	0	0	6	0	0
	Autumn	0	0	0	0	12	0	0
	Winter	0	0	0	25	50	.....	.....
	Annual	0	0	0	2	9	0	0
S	Apring	0	0	0	5	12	33	0
	Summer	0	0	0	0	5	33	50
	Autumn	0	0	0	7	23	29	50
	Winter	0	0	0	37	64	83	.....
	Annual	0	0	0	8	20	43	40
SSW	Spring	0	0	0	12	27	67	100
	Summer	0	0	10	20	57	60	.....
	Autumn	0	0	5	25	23	38	.....
	Winter	0	0	22	43	62	75	100
	Annual	0	0	9	24	38	55	100
SW	Spring	0	0	0	17	100	.....	.....
	Summer	0	0	12	50	80	100	.....
	Autumn	0	0	12	14	20	0	.....
	Winter	0	0	45	67	71	50	50
	Annual	0	0	21	39	63	57	50
WSW	Spring	0	0	40	50	100	100	.....
	Summer	0	0	33	67	67	.....	.....
	Autumn	0	0	42	58	88	100	100
	Winter	0	0	71	100	100	100	100
	Annual	0	0	48	69	90	100	100
W	Spring	50	50	71	75	70	67	.....
	Summer	50	54	75	70	29	0	.....
	Autumn	50	52	87	86	73	67	100
	Winter	50	57	93	100	90	100	.....
	Annual	50	53	82	84	69	62	100
WNW	Spring	100	100	100	67	33	67	50
	Summer	100	100	100	93	83	75	100
	Autumn	100	100	96	100	90	89	100
	Winter	100	100	100	93	100	83	.....
	Annual	100	100	98	93	82	77	67
NW	Spring	100	100	100	96	87	67	100
	Summer	100	100	100	94	92	86	0
	Autumn	100	100	97	92	83	71	.....
	Winter	100	100	100	97	92	88	67
	Annual	100	100	99	95	88	74	60
NNW	Spring	100	100	100	100	92	75	50
	Summer	100	100	100	100	89	100	100
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	100	100	92	86	0
	Annual	100	100	100	100	93	88	50
Means	Spring	54	54	52	50	53	60	57
	Summer	48	48	46	43	48	58	44
	Autumn	58	57	58	56	57	57	62
	Winter	65	65	68	76	82	83	56
	Annual	56	55	56	57	59	64	55

TABLE 18d.—*Average percentage frequency of a north component in winds at various levels at Groesbeck, Tex.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		141	500	1,000	2,000	3,000	4,000	5,000
N	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	.....	.....	.....	.....
	Autumn	100	100	100	100	100	100	.....
	Winter	100	100	96	86	86	100	100
	Annual	100	100	98	93	93	100	100
NNE	Spring	100	100	100	100	75	100	100
	Summer	100	100	100	0	.....	.....	.....
	Autumn	100	96	94	100	88	100	.....
	Winter	100	95	88	83	83	67	100
	Annual	100	97	94	92	83	88	100
NE	Spring	100	100	100	100	100	.....	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	100	67	100	100
	Winter	100	78	67	100	.....	.....	.....
	Annual	100	92	90	100	75	100	100
ENE	Spring	100	67	67	60	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	75	67	33	100	.....	.....
	Winter	100	100	100	.....	.....	.....	.....
	Annual	100	73	70	50	100	.....	.....
E	Spring	50	14	17	0	.....	.....	.....
	Summer	50	0	0	0	.....	.....	.....
	Autumn	50	12	12	0	0	.....	.....
	Winter	50	0	0	.....	.....	.....	.....
	Annual	50	9	10	0	0	.....	.....
ESE	Spring	0	0	0	0	0	.....	.....
	Summer	0	0	10	0	0	.....	.....
	Autumn	0	0	0	0	0	.....	.....
	Winter	0	0	0	0	0	0	.....
	Annual	0	0	3	0	0	0	.....
SE	Spring	0	0	0	0	0	.....	.....
	Summer	0	0	0	0	.....	.....	.....
	Autumn	0	0	0	0	0	0	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	0	0	0	0	0	.....
SSE	Spring	0	0	0	0	0	0	.....
	Summer	0	0	0	0	0	0	.....
	Autumn	0	0	0	0	0	0	.....
	Winter	0	0	0	0	0	.....	.....
	Annual	0	0	0	0	0	0	.....
S	Spring	0	0	0	0	0	0	.....
	Summer	0	0	0	0	17	100	.....
	Autumn	0	0	0	0	5	0	0
	Winter	0	0	0	0	7	0	.....
	Annual	0	0	0	0	6	10	0
SSW	Spring	0	0	0	11	9	0	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	5	6	0	.....
	Winter	0	0	4	14	14	0	0
	Annual	0	0	1	7	8	0	0
SW	Spring	0	0	12	17	0	.....	.....
	Summer	0	0	0	0	0	.....	.....
	Autumn	0	0	0	0	0	.....	.....
	Winter	0	0	7	33	67	67	100
	Annual	0	0	4	15	32	67	100
WSW	Spring	0	0	17	20	0	0	.....
	Summer	0	0	14	0	0	.....	.....
	Autumn	0	17	25	25	100	.....	.....
	Winter	0	50	50	.....	.....	.....	.....
	Annual	0	9	21	14	17	0	.....
W	Spring	50	100	.....	.....	.....	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	50	100	100	100	.....	.....	.....
	Winter	50	71	86	80	50	100	.....
	Annual	50	82	90	86	50	100	.....
WNW	Spring	100	100	75	50	50	.....	.....
	Summer	100	100	100	100	.....	.....	.....
	Autumn	100	100	100	100	100	.....	.....
	Winter	100	100	100	86	75	100	.....
	Annual	100	100	94	86	75	100	.....
NW	Spring	100	100	100	75	100	.....	.....
	Summer	.....	.....	.....	.....	.....	.....	.....
	Autumn	100	100	100	86	67	50	.....
	Winter	100	100	100	91	88	100	.....
	Annual	100	100	100	86	81	67	.....
NNW	Spring	100	100	100	100	83	100	.....
	Summer	100	100	100	100	100	100	.....
	Autumn	100	100	100	100	75	.....	.....
	Winter	100	100	100	100	80	100	.....
	Annual	100	100	100	100	82	100	.....
Means	Spring	32	30	30	28	24	50	100
	Summer	12	10	13	6	10	67	.....
	Autumn	42	40	38	34	31	38	50
	Winter	54	53	50	47	46	57	50
	Annual	37	35	34	31	31	49	62

TABLE 18e.—*Average percentage frequency of a north component in winds at various levels at Leesburg, Ga.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		85	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	100	100	100				
	Summer	100	100	100				
	Autumn	100	100	100	100	100	100	
	Winter	100	100	100	100	100	100	100
	Annual	100	100	100	100	100	100	100
NNE.	Spring	100	100	100				
	Summer							
	Autumn	100	100	100				
	Winter	100	100	100	100	100		
	Annual	100	100	100	100	100		
NE.	Spring	100	100	100	100			
	Summer	100	100	100	100			
	Autumn	100	100	100	100	100		
	Winter	100	100	60	100			
	Annual	100	100	79	100	100		
ENE.	Spring	100	80	50	50	50		
	Summer	100	67	50	60	50	50	
	Autumn	100	83	67	100	100		
	Winter	100	67	50	67	100		
	Annual	100	74	55	67	67	50	
E.	Spring	50	50	0	0			
	Summer	50	54	44	28	33		
	Autumn	50	50	40	43	50		
	Winter	50	0	0				
	Annual	50	48	35	31	40		
ESE.	Spring	0	0	0				
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0	0	0	
	Winter	0	0					
	Annual	0	0	0	0	0	0	
SE.	Spring	0	0	0	0	0	0	0
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0			
	Winter							
	Annual	0	0	0	0	0	0	0
SSE.	Spring	0	0	0	0	0		
	Summer							
	Autumn	0	0	0	0			
	Winter	0	0	0	0	0	0	
	Annual	0	0	0	0	0	0	
S.	Spring	0	0	0	0	0	0	0
	Summer	0	0	0				
	Autumn	0	0	0	0	0		
	Winter	0	0	0	0	0		
	Annual	0	0	0	0	0	0	0
SSW.	Spring	0	0	0	0	0		
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0	0	0	
	Winter	0	0	0	0	0		
	Annual	0	0	0	0	0	0	
SW.	Spring	0	0	0	25	25		
	Summer	0	0	0				
	Autumn	0	0	0	0	0	0	
	Winter	0	0	17	40	40	50	
	Annual	0	0	6	30	33	33	
WSW.	Spring	0	0	0	0			
	Summer	0	0	0	0	0	0	
	Autumn	0	50	50				
	Winter	0	11	29	57	60	0	
	Annual	0	13	25	44	50	0	
W.	Spring	50	50	50	100	100		
	Summer	50	44	33	40	25	0	
	Autumn	50	50	50	50	50		
	Winter	50	43	50	67	100		
	Annual	50	42	38	55	50	0	
WNW.	Spring	100	82	73	60	40	33	
	Summer	100	100	100	100			
	Autumn	100	100	100	100	100	100	
	Winter	100	100	100	100	100		
	Annual	100	86	86	82	64	50	
NW.	Spring	100	100	100	100	100	100	
	Summer	100	100	100	100	100		
	Autumn							
	Winter	100	100	100	86	75	100	
	Annual	100	100	100	91	86	100	
NNW.	Spring	100	100	100	100	100	100	
	Summer							
	Autumn	100	100	100	100	100	100	100
	Winter	100	100	100	100	100	100	
	Annual	100	100	100	100	100	100	100
Means.	Spring	44	42	33	32	36	38	0
	Summer	43	39	33	38	27	20	
	Autumn	49	47	50	43	47	14	0
	Winter	50	48	50	56	54	50	100
	Annual	46	44	41	45	44	31	25

TABLE 18f.—*Average percentage frequency of a north component in winds at various levels at Royal Center, Ind.*

Surface direction.	Season.	Altitude above m. s. l. (meters).						
		225	500	1,000	2,000	3,000	4,000	5,000
N.	Spring	100	100	100	100	100		
	Summer	100	100	100	100	100		
	Autumn	100	100	100	100	100		
	Winter	100	100	100	100			
	Annual	100	100	100	100	100		
NNE.	Spring	100	100	100	100	100		
	Summer	100	100	100	100	100		
	Autumn	100	100	100	100	100	100	
	Winter	100	100	100	100			
	Annual	100	100	100	100	100	100	100
NE.	Spring	100	100	100	100	100		
	Summer	100	100	75	67	100		
	Autumn	100	100	100	100	100		
	Winter	100	100	100	100	100		
	Annual	100	100	93	91	100		
ENE.	Spring	100	100	100	100	100		
	Summer	100	100	67	100	100		
	Autumn	100	100	100				
	Winter	100	100	86	100	100		
	Annual	100	100	87	100	100		
E.	Spring	50	43	28	44	33	50	
	Summer	50	33	50	100	100		
	Autumn	50	57	60	25			
	Winter	50	33	33	50	50		
	Annual	50	42	39	50	50	100	
ESE.	Spring	0	0	0	33	0		
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0	0		
	Winter	0	0	20	0	0		
	Annual	0	0	5	7	0		
SE.	Spring	0	0	0	0	0		
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0	0	0	
	Winter	0	0	0	0	0		
	Annual	0	0	0	0	0	0	
SSE.	Spring	0	0	0	0	0	0	
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0	0		
	Winter	0	0	0	8	12	0	
	Annual	0	0	0	4	6	0	
S.	Spring	0	0	0	10	20	50	100
	Summer	0	0	0	0	0		
	Autumn	0	0	0	0	10	0	
	Winter	0	0	0	20	50	0	
	Annual	0	0	0	6	11	12	100
SSW.	Spring	0	0	0	0	14	0	
	Summer	0	8	15	10	12	50	
	Autumn	0	0	0	0	6	0	
	Winter	0	0	0	10	0	0	
	Annual	0	2	4	4	9	20	
SW.	Spring	0	0	0	14	25	100	
	Summer	0	0	5	19	25	33	
	Autumn	0	0	7	21	40	67	
	Winter	0	0	21	38	40		
	Annual	0	0	9	24	34	57	
WSW.	Spring	0	0	20	38	60	0	
	Summer	0	0	17	19	20	50	
	Autumn	0	6	31	67	60	100	
	Winter	0	7	33	36	33		
	Annual	0	3	25	38	38	60	
W.	Spring	50	56	64	58	62	100	
	Summer	50	60	50	58	38	100	
	Autumn	50	57	65	56	71	100	
	Winter	50	68	75	82	60	0	
	Annual	50	62	67	66	62	86	
WNW.	Spring	100	100	100	100	100	100	
	Summer	100	100	100	75	100		
	Autumn	100	100	95	82	62	50	
	Winter	100	86	78	78	80	100	
	Annual	100	95	91	82	78	80	
NW.	Spring	100	100	100	100	100		
	Summer	100	100	100	100	100	100	
	Autumn	100	100	100	100	100		
	Winter	100	100	100	100	100		
	Annual	100	100	100	100	100	100	
NNW.	Spring	100	100	100	100	100	100	
	Summer	100	100	100	100	100		
	Autumn	100	100	100	100	100		
	Winter	100	100	100	100	100		
	Annual	100	100	100	100	100	100	
Means.	Spring	39	39	40	47	54	60	100
	Summer	35	36	40	44	43	60	
	Autumn	35	36	39	41	40	44	
	Winter	36	39	45	48	48	29	
	Annual	36	37	41	44	45	50	100

NOTE.—In Tables 18a to 18f winds recorded exactly "east" or "west" have been considered as having had a northerly component in 50 per cent of the cases.

TABLE 19a.—*Average percentage frequency of a north component in the free-air winds at three northern stations—Drexel, Ellendale, and Royal Center.*

Summer.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.[1]	500	1,000	2,000	3,000	4,000
N	100	100	100	100	100	100
NNE	100	100	96	94	89	100
NE	100	100	83	63	71	86
ENE	100	98	66	64	75	0
E	50	38	34	37	33	0
ESE	0	0	0	0	0	.....
SE	0	0	0	0	5	25
SSE	0	0	0	0	3	4
S	0	0	0	1	3	16
SSW	0	3	9	12	26	42
SW	0	0	6	26	46	61
WSW	0	0	23	42	42	25
W	50	55	70	70	49	56
WNW	100	100	95	82	85	88
NW	100	100	99	97	96	83
NNW	100	100	100	99	93	90
Means	40	40	40	41	44	53

Winter.

N	100	100	99	97	98	75
NNE	100	100	93	89	84	.....
NE	100	100	82	75	100	.....
ENE	100	95	55	33	50	.....
E	50	30	15	22	22	0
ESE	0	0	7	0	11	25
SE	0	0	0	11	13	25
SSE	0	0	0	13	32	22
S	0	0	0	21	45	52
SSW	0	0	8	28	42	58
SW	0	0	29	52	54	50
WSW	0	7	52	72	70	81
W	50	62	86	90	85	62
WNW	100	95	91	86	89	86
NW	100	100	100	99	96	82
NNW	100	100	100	99	95	78
Means	52	53	57	62	66	60

Annual.

N	100	100	100	98	97	90
NNE	100	100	97	93	94	94
NE	100	100	88	79	81	91
ENE	100	98	66	56	51	33
E	50	38	28	26	27	33
ESE	0	0	2	2	3	12
SE	0	0	[2] 0	3	6	7
SSE	0	0	0	2	8	4
S	0	0	0	6	14	27
SSW	0	1	5	14	25	39
SW	0	0	13	31	46	53
WSW	0	4	37	56	65	76
W	50	58	76	78	73	77
WNW	100	98	95	87	80	79
NW	100	100	99	98	93	81
NNW	100	100	100	99	95	87
Means	46	46	48	50	52	56

[1] Average surface altitude, 350 m. above m. s. l.
[2] Less than 0.5 per cent.

TABLE 19b.—*Average percentage frequency of a north component in the free-air winds at three southern stations—Broken Arrow, Groesbeck, and Leesburg.*

Summer.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.[1]	500	1,000	2,000	3,000	4,000
N	100	100	100	100	.....	.....
NNE	100	100	100	50	.....	.....
NE	100	100	100	96	.....	.....
ENE	100	84	75	60	50	50
E	50	29	26	9	33	.....
ESE	0	0	3	0	0	.....
SE	0	0	0	0	0	0
SSE	0	0	0	0	0	0
S	0	0	0	2	18	50
SSW	0	0	0	2	0	0
SW	0	0	0	0	0	.....
WSW	0	0	38	33	33	0
W	50	47	42	20	25	0
WNW	100	100	100	100	100	.....
NW	100	100	100	100	100	.....
NNW	100	100	100	100	100	100
Means	25	23	22	21	16	29

Winter.

N	100	100	99	95	95	100
NNE	100	98	93	88	92	67
NE	100	93	76	100	100	.....
ENE	100	84	75	67	100	.....
E	50	0	0	.....	.....	.....
ESE	0	0	0	0	0	0
SE	0	0	0	0	0	.....
SSE	0	0	0	0	17	0
S	0	0	0	0	2	0
SSW	0	0	1	11	16	50
SW	0	2	18	48	63	72
WSW	0	20	37	28	60	0
W	50	60	68	82	83	100
WNW	100	100	100	95	92	100
NW	100	100	100	92	88	100
NNW	100	100	100	100	93	100
Means	49	48	49	52	56	62

Annual.

N	100	100	99	96	98	100
NNE	100	99	95	92	83	44
NE	100	97	89	95	86	67
ENE	100	82	55	39	84	50
E	50	23	19	10	20	.....
ESE	0	0	1	7	0	0
SE	0	0	0	0	0	0
SSE	0	0	0	0	1	0
S	0	0	0	[2] 0	5	9
SSW	0	0	[2] 0	4	6	13
SW	0	1	7	26	41	60
WSW	0	7	25	25	56	0
W	50	57	58	67	69	50
WNW	100	95	91	85	80	75
NW	100	100	100	92	85	89
NNW	100	100	100	100	94	100
Means	39	37	35	35	35	38

[1] Average surface altitude, 150 m. above m. s. l.
[2] Less than 0.5 per cent.

TABLE 19c.—*Average percentage frequency of a north component in the free-air winds at all six stations.*

Summer.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.[1]	500	1,000	2,000	3,000	4,000
N.	100	100	100	100	100	100
NNE.	100	100	98	77	89	100
NE.	100	100	92	80	71	86
ENE.	100	92	69	63	67	25
E.	50	33	30	23	33	0
ESE.	0	0	2	0	0	.....
SE.	0	0	0	0	5	17
SSE.	0	0	0	0	2	2
S.	0	0	0	1	9	33
SSW.	0	1	5	7	13	31
SW.	0	0	3	16	27	61
WSW.	0	0	30	38	38	17
W.	50	52	59	50	43	42
WNW.	100	100	98	91	89	88
NW.	100	100	99	98	97	83
NNW.	100	100	100	99	95	93
Means.	33	32	31	31	30	41

Winter.

N.	100	100	99	96	96	88
NNE.	100	99	93	88	88	67
NE.	100	96	79	88	100	.....
ENE.	100	90	63	42	67	.....
E.	50	18	9	22	22	0
ESE.	0	0	4	0	8	17
SE.	0	0	0	6	16	25
SSE.	0	0	0	6	24	14
S.	0	0	0	11	7	31
SSW.	0	0	5	20	29	55
SW.	0	1	23	50	58	65

[1] Average surface altitude, 250 m. above m. s. l.

TABLE 19c. *Average percentage frequency of a north component in the free-air winds at all six stations*—Continued.

Winter—Continued.

Surface direction.	Altitude above m. s. l. (meters).					
	Surface.	500	1,000	2,000	3,000	4,000
WSW.	0	14	45	55	68	54
W.	50	61	77	86	84	72
WNW.	100	98	96	91	90	90
NW.	100	100	100	96	92	93
NNW.	100	100	100	100	94	89
Means.	51	51	53	57	61	61

Annual.

N.	100	100	100	97	98	96
NNE.	100	100	96	92	88	74
NE.	100	99	88	87	84	96
ENE.	100	90	60	48	64	39
E.	50	30	23	18	24	33
ESE.	0	0	1	4	2	5
SE.	0	0	[1] 0	1	3	4
SSE.	0	0	0	1	5	2
S.	0	0	0	3	9	18
SSW.	0	[1] 0	2	9	16	26
SW.	0	[1] 0	10	28	44	56
WSW.	0	6	31	40	60	46
W.	50	58	67	72	71	66
WNW.	100	97	93	86	80	97
NW.	100	100	100	95	89	85
NNW.	100	100	100	100	94	93
Means.	42	42	42	42	44	47

[1] Less than 0.5 per cent.

NOTE.—In Tables 19a to 19c winds recorded exactly "east" or "west" have been considered as having had a northerly component in 50 per cent of the cases.

TABLE 20.—*Average percentage frequency of free-air wind velocities 10 m. p. s. and over and 20 m. p. s. and over.*

Broken Arrow, Okla.

M. p. s.	10+	20+	10+	20+	10+	20+	10+	20+	10+	20+	10+	20+	10+	20+
Season.	Altitude above m. s. l. (meters).													
	233		500		1,000		2,000		3,000		4,000		5,000	
Spring	27	0	52	2	62	6	61	4	78	9	100	29	.....	.....
Summer	4	0	25	0	38	1	31	3	45	0	100	0	.....	.....
Autumn	16	0	50	0	59	4	73	7	67	7	93	21	100	25
Winter	17	0	58	3	72	11	82	13	96	31	100	20	100	0
Annual	17	0	43	2	58	5	60	6	70	10	97	19	100	20

Drexel, Nebr.

Season.	Altitude above m. s. l. (meters).													
	396		500		1,000		2,000		3,000		4,000		5,000	
Spring	16	0	33	1	65	12	77	17	88	27	95	41	100	40
Summer	3	0	17	0	57	5	63	5	78	8	87	10	83	58
Autumn	4	0	22	0	72	9	78	14	91	22	94	29	100	16
Winter	8	0	27	0	77	10	89	23	96	38	99	50	100	40
Annual	8	0	25	2	68	9	77	15	89	25	94	31	96	35

Ellendale, N. Dak.

Season.	Altitude above m. s. l. (meters).													
	444		500		1,000		2,000		3,000		4,000		5,000	
Spring	28	0	34	0	60	5	71	12	83	20	97	31	100	100
Summer	12	0	17	0	50	2	55	5	69	8	88	23	100	22
Autumn	13	0	20	0	60	6	70	12	89	19	98	30	100	50
Winter	22	0	26	0	64	9	80	18	93	28	100	37	100	50
Annual	19	0	24	0	59	5	69	12	83	19	96	30	100	53

Groesbeck, Tex.

Season.	Altitude above m. s. l. (meters).													
	141		500		1,000		2,000		3,000		4,000		5,000	
Spring	15	0	57	4	61	12	60	11	81	20	100	12	100	50
Summer	1	0	30	0	34	1	24	0	27	0	100	0	.....	.....
Autumn	2	0	54	1	63	4	63	8	72	14	89	11	100	0
Winter	10	0	52	3	67	11	78	10	93	18	94	6	100	33
Annual	7	0	50	2	58	8	60	8	75	15	94	9	100	29

Leesburg, Ga.

Season.	Altitude above m. s. l. (meters).													
	85		500		1,000		2,000		3,000		4,000		5,000	
Spring	3	0	42	1	61	3	78	3	92	17	100	29	100	0
Summer	4	0	22	2	41	3	62	8	71	0	75	0	.....	.....
Autumn	2	0	39	2	36	0	50	3	83	11	100	29	100	100
Winter	4	0	54	2	74	2	82	18	92	27	100	17	100	0
Annual	3	0	41	2	57	2	71	9	87	17	96	21	100	25

Royal Center, Ind.

Season.	Altitude above m. s. l. (meters).													
	225		500		1,000		2,000		3,000		4,000		5,000	
Spring	18	0	50	2	65	10	77	16	89	19	87	7	100	0
Summer	3	0	20	0	36	0	51	4	79	11	100	0	.....	.....
Autumn	3	0	31	0	52	2	65	6	84	11	100	0	.....	.....
Winter	10	0	46	1	66	9	92	23	91	32	100	43	.....	.....
Annual	8	0	36	1	55	5	71	12	85	18	96	9	100	0

TABLE 21.—*Maximum free-air wind velocities, m. p. s.*

Broken Arrow, Okla.

Season.	Altitude above m. s. l. (meters).													
	233		500		1,000		2,000		3,000		4,000		5,000	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Spring	s.	17	s.	24	s.	27	ssw.	28	ssw.	24	ssw.	23	.....	.....
Summer	ne.	11	nw.	19	nw.	25	nw.	26	w.	18	ssw.	18	.....	.....
Autumn	s.	14	sse.	20	sse.	22	s.	27	sw.	22	wnw.	24	w.	20
Winter	n.	17	s.	26	ssw.	32	ssw.	27	w.	30	wnw.	21	wnw.	17

Drexel, Nebr.

Season.	Altitude above m. s. l. (meters).													
	396		500		1,000		2,000		3,000		4,000		5,000	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Spring	wnw.	18	s.	20	nnw.	31	wnw.	32	nw.	35	nw.	34	w.	26
Summer	ese.	15	ese.	17	wsw.	30	sw.	25	ssw.	33	sw.	24	nw.	25
Autumn	wnw.	15	ssw.	18	nw.	36	nw.	33	nw.	31	nw.	30	w.	34
Winter	nnw.	14	sw.	21	wnw.	37	nw.	31	wnw.	32	sw.	33	w.	29

Ellendale, N. Dak.

Season.	Altitude above m. s. l. (meters).													
	444		500		1,000		2,000		3,000		4,000		5,000	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Spring	nnw.	18	nnw.	18	ssw.	30	nnw.	26	w.	29	w.	28	wsw.	24
Summer	s.	14	sse.	15	s.	24	nw.	23	wsw.	29	w.	23	wnw.	27
Autumn	nw.	29	nw.	28	nnw.	30	wnw.	28	ssw.	31	w.	31	w.	26
Winter	nnw.	19	n.	18	ssw.	40	w.	27	w.	31	nnw.	27	sw.	26

Groesbeck, Tex.

Season.	Altitude above m. s. l. (meters).													
	141		500		1,000		2,000		3,000		4,000		5,000	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Spring	w.	17	s.	22	ssw.	23	ssw.	30	sw.	32	wnw.	26	wnw.	22
Summer	nnw.	11	nnw.	17	sw.	21	nw.	16	nw.	16	w.	16	.....	.....
Autumn	wsw.	13	s.	22	ene.	24	ssw.	24	wnw.	27	nw.	21	w.	17
Winter	n.	15	s.	23	ssw.	31	nnw.	29	w.	28	ssw.	27	nw.	23

Leesburg, Ga.

Season.	Altitude above m. s. l. (meters).													
	85		500		1,000		2,000		3,000		4,000		5,000	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Spring	wsw.	13	se.	21	sw.	21	wnw.	22	wsw.	23	sw.	21	wsw.	18
Summer	sw.	10	e.	22	ese.	21	ese.	20	ese.	16	sw.	13	.....	.....
Autumn	s.	10	s.	21	ssw.	19	wsw.	25	w.	22	w.	23	w.	20
Winter	wsw.	12	ssw.	21	ssw.	22	nw.	28	w.	28	wnw.	21	nw.	16

Royal Center, Ind.

Season.	Altitude above m. s. l. (meters).													
	225		500		1,000		2,000		3,000		4,000		5,000	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Spring	wsw.	15	ssw.	23	ssw.	34	ssw.	37	wnw.	30	wnw.	24	nnw.	19
Summer	nne.	11	e.	18	wsw.	19	wnw.	22	sw.	24	wnw.	19	.....	.....
Autumn	w.	13	sw.	18	s.	25	wsw.	27	w.	24	w.	18	.....	.....
Winter	w.	14	s.	20	ssw.	38	ssw.	29	wsw.	33	wsw.	30	.....	.....